PRELIMINARY

ECONOMIC AND ENGINEERING STUDY

TUG AND BARGE CONSTRUCTION PROGRAM

FOR

THE GOVERNMENT OF VIET-NAM

AND

THE UNITED STATES

OPERATIONS MISSION TO VIET-NAM

Contract No. AID-430-990

PIO/T 430-303-3-50142

DMJM

DANIEL, MANN, JOHNSON, & MENDENHALL

40 HONG THAP TU SAIGON, VIET-NAM

PLANNING § ARCHITECTURE § ENGINEERING § SYSTEMS

Small River Tug With
Barge in Tow on the
Saigon River

June, 1965

PRELIMINARY ECONOMIC AND ENGINEERING STUDY

DEVELOPMENT OF HARBOR FACILITIES

TUG AND BARGE

CONSTRUCTION PROGRAM

Based upon Field Studies Conducted
April through June, 1965

for

THE GOVERNMENT OF VIET-NAM

and

THE UNITED STATES
OPERATIONS MISSION TO VIET-NAM

February 1966

Contract No. AID 430-990
PIO/T 430-303-3-50142

DANIEL, MANN, JOHNSON, & MENDENHALL
40 Hong Thap Tu, Saigon, Viet-Nam

and

3325 Wilshire Blvd., Los Angeles, California

DMJM

DANIEL, MANN, JOHNSON, & MENDENHALL

Saigon, Viet-Nam
January 31, 1966

His Excellency
Ngo Trong Anh
Minister of Public Works & Communications
Republic of Viet-Nam
Saigon, Viet-Nam

Re: Contract No. AID 430-990
PIO/T 430-303-3-50142
DMJM Project No. 840-5-2

Your Excellency:

We are pleased to submit herewith, in accordance with the terms of the above referenced contract, our PRELIMINARY ECONOMIC AND ENGINEERING STUDY ON THE TUG AND BARGE CONSTRUCTION PROGRAM for Viet-Nam.

As the Tug and Barge phase of our contract was cancelled by U.S.O.M. on June 18, 1965, this report summarizes the studies and investigations carried out by our tug and barge expert over a period of only about two months. This represents approximately one-third of the time initially scheduled for this particular assignment. Consequently, this report and material presented herein is more of a statistical nature than an in-depth study of all aspects of tug and barge construction in Viet-Nam as originally planned.

In the limited time available, however, field trips were made to inspect the repair facilities at Can Tho, and barge and tug operations and barge fabrication at Danang. Also considerable time was spent in inspecting the facilities of CARIC and other barge fabricators in the Saigon area. In addition, a considerable number of interviews were held with various shipping and stevedoring companies to solicit their opinions and obtain statistics relative to their operations.

As this report is only one of a series of seventeen volumes prepared under this contract, we suggest reference to some of these other reports for information on specific subjects defined in our over-all contract scope of work. In particular, we suggest review of the volume entitled "BASIC INFORMATION-CONDITIONS AND CRITERIA" relative to general oceanographic and economic data on Viet-Nam which is pertinent to all reports.

It has been a pleasure to be of service to the Government of Viet-Nam and we would like to express our appreciation to Vice Minister Tuan, Messrs. Dat, Nguyen, Tuong, and others of the Directorate of Navigation for the many courtesies extended to us during the period of our work in Viet-Nam.

Yours very truly,

DANIEL, MANN, JOHNSON, & MENDENHALL

Donald A. Walsh
Project Manager

DAW/ot

DMJM

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IX. COST SUMMARY

NOTE:

(1) See volume titled "Basic Information, Conditions & Criteria" for general background.

(2) This report is one of a series of individual reports covering the Ports of Hue, Da Nang, Quang Ngai, Qui Nhon, Nha Trang, Cam Ranh, Phan Thiet, Vung Tau, Saigon, Can Tho, Rach Gia and Ha Tien, and subjects of Cargo Handling, Warehousing, Tugs and Barges, and Dredging.

I. SUMMARY

By letter of June 18, 1965, from Jack L. Nelson, Acting Chief of the U. S. O. M. Public Works Division, the tug and barge aspect of the overall study program was deleted from the DMJM contract with instructions to terminate or transfer as soon as possible all personnel associated with this activity. A copy of this letter follows in this section of the report.

Tug and barge specialists spent the period from June 18 to June 27 assembling their notes and outlining their activities relative to the work they had been performing. As of June 27, no personnel were any longer engaged on this phase of the original program. This report represents a summary of their activities and recommendations up to June 27.

The importance of junks, barges, lighters and tugs in the transportation of cargo from Saigon to the provinces and from the provinces to Saigon, or from one delta town to another, can best be understood after a review of the extensive network of natural and man-made waterways and canals in South Viet-Nam.

South Viet-Nam is second only to Holland in the length of navigable waterways per unit area; specifically, 74 kilometers of waterways per 1,000 square kilometers.

Consequently, it is of prime importance to the economy of the country that the fleet of barges, lighters, junks and tugs plying the waterways of South Viet-Nam is at all times adequate in number and in carrying capacity to meet the needs of waterway transportation.

The restoration and rehabilitation of the primary waterways and canals in South Viet-Nam was the subject of a thorough study by DMJM in 1960, while the barge and tug requirements were previously investigated by the United Nations Goodrich Mission in 1955-1956, and later in 1962 by the United Nations Committee for Coordination of Investigations of the Lower Mekong Basin. A portion of the United Nations study is included as Appendix "A" in this report.

Because studies on barge and tug requirements were terminated while still in the process of collecting data and information on the subject, final conclusions and recommendations are quite limited in scope. Consequently, the data and information presented herein relative to the present operations and our preliminary studies on the future needs for barges, lighters, and tugs must of necessity be subject to critical review by those to whom this report is directed.

First impressions were that, for the present at least, the tug and barge problem was not sufficiently serious to warrant a crash construction program. Instead, it would seem that more efficient cargo handling operations and better housekeeping on the docks would be considerably more value at this time.

There can be no doubt, however, that over the next few years many of the old wooden junks will have to be retired from service and replaced with steel barges. At Danang, there is a particularly serious cargo lightering problem and there is a definite need for several large lighters and more tugs. In the Saigon area, there is presently quite a number of barges which are owned by the Commercial Port of Saigon and which are out of service due to the need for extensive maintenance and repairs. If this repair work is undertaken, then the immediate requirements for Saigon could probably be taken care of with one additional large 550-ton lighter and one tug, in addition to the repaired barges.

Based upon these rather superficial observations, the following is recommended for the first year's tug and barge construction program:

A.	Repair of 20 barges - Port of Saigon	=	$ 177,700
B.	Construction of 22 new 250-ton barges	=	1,774,960
C.	Construction of 4 new 550-ton lighters	=	366,520
D.	Construction of 3 new 400-HP tugs	=	533,400
	TOTAL	=	$ 2,852,580

Even though these requirements are based upon rather preliminary information, it is believed that this program is realistic and necessary. Whether it should be continued for a second year or beyond will depend upon the success and method of implementing the first year's requirements.

UNITED STATES OPERATIONS MISSION TO VIETNAM

AMERICAN EMBASSY
SAIGON VIETNAM

June 18, 1965

Mr. Donald A. Walsh
Project Manager
Daniel, Mann, Johnson & Mendenhall
Olympic Annex
Saigon, Vietnam

Dear Mr. Walsh:

Mission planning with regard to the program providing for tug and barge design and construction has been altered. Instead of implementing the project through grant aid to the Government of Vietnam Office of Navigation, it has now been determined that the Commercial Import Program will be utilized for the purpose. Under the Commercial Import Program, design and construction of the tugs and barges will be handled entirely through private enterprise channels. The GVN Ministry of Public Works and the Office of Navigation will have little or no active participation in the project.

With this change in planning, it is felt that further work in the tug and barge field can no longer be considered to fall under the scope of work of the Daniel, Mann, Johnson & Mendenhall contract. Your efforts to date are appreciated and the information developed has been useful. However, under the present circumstances, you are requested to cease any further work on tugs and barges, other than preparation of a report delineating your activities to the present time, and to take immediate steps to demobilize any of your personnel concerned solely in this field.

Sincerely yours,

Jack L. Nelson

JACK L. NELSON
Acting Chief
Public Works Division

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II. WATERWAYS AND WATERWAY TRANSPORT IN SOUTH VIET-NAM

Viet-Nam's Navigable Waterway System

The Mekong Delta area covers a quarter of South Viet-Nam and contains about half of its population. It is one of Asia's most productive rice-growing areas. The Delta is traversed by the Mekong, which divides into five branches, the other four being the Bassac, the two Vaicos and the River Saigon. In addition, a great number of natural and artificial waterways give access to nearly all inhabited localities in the interior of the Delta area. See Exhibit #1.

The navigable waterways of South Viet-Nam total 5,032 km, made up approximately as follows:

Large Rivers	1,252 km
Small Rivers	1,411 km
Main Canals	1,594 km
Second Class Canals	612 km
Third Class Canals	163 km
	5,032 km

Exhibit #1A shows the general pattern and volume distribution of delta traffic for 1937 - 1938 which is more representative of peacetime conditions than present traffic patterns.

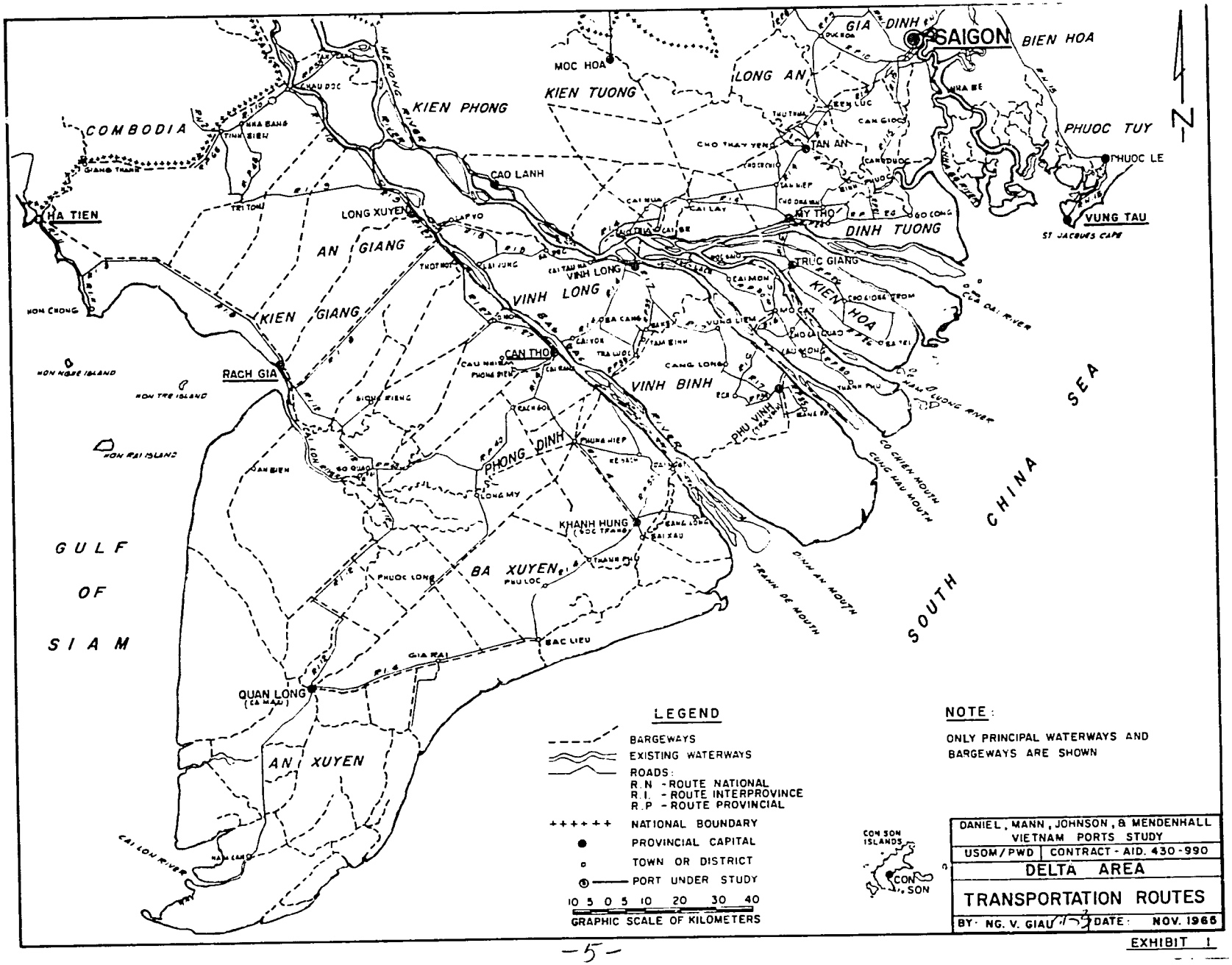

EXHIBIT 1

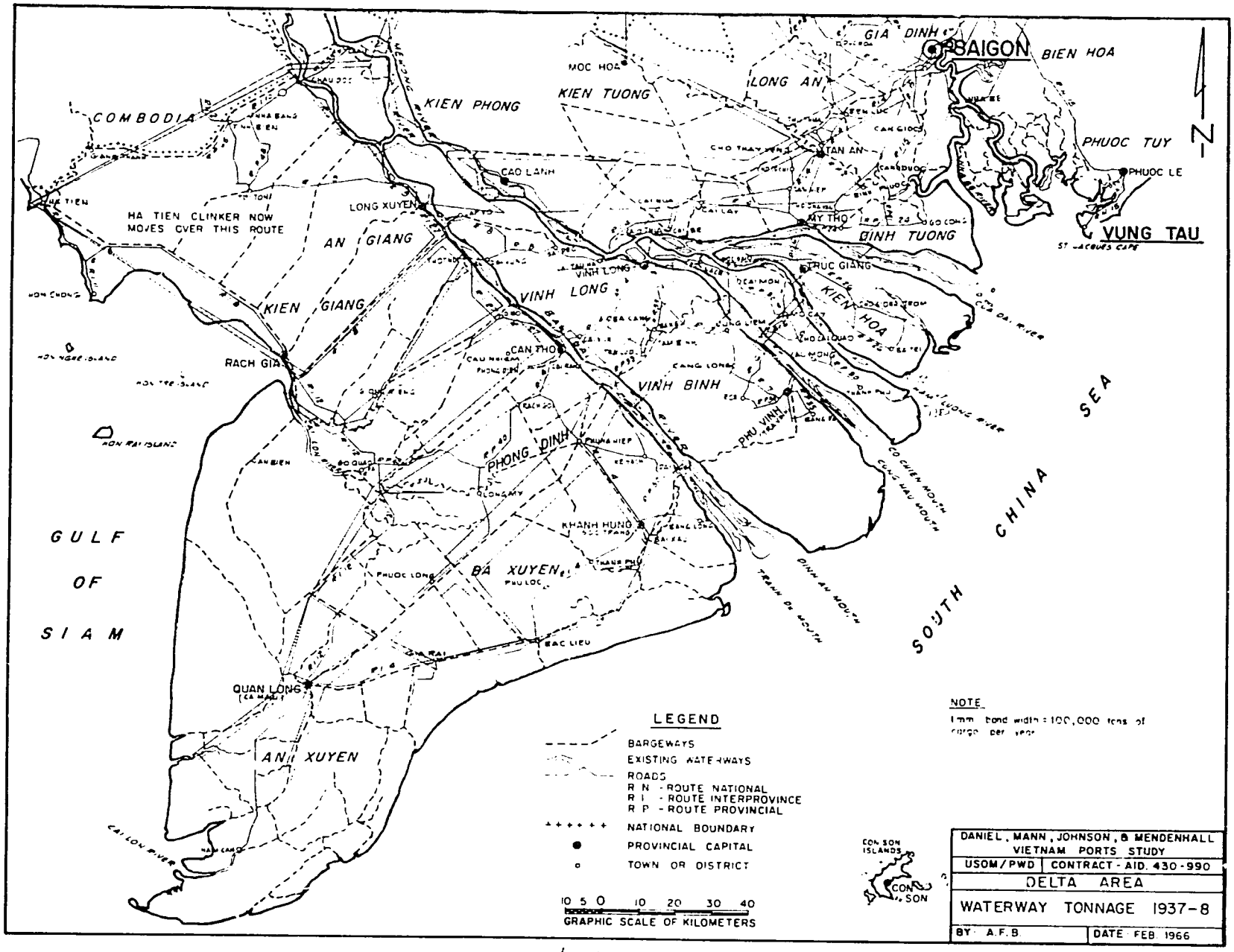

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EXHIBIT I-A

As the area of South Viet-Nam is about 67,863 km^2, this represents an average of 74 km of navigable waterway per 1,000 km^2, the highest after Holland.

The canals have the following basic dimensions:

	Cross Section in M^2	Width in M	Depth in M
Main Canals	90 - 120	40	3.5 - 4
Second Class Canals	40 - 90	25	2.5 - 3
Third Class Canals	8 - 15	10	1.5 - 2

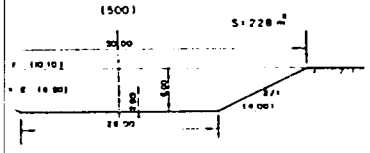
The typical cross sections details for the principal canals and waterways of South Viet-Nam are as shown in Exhibit #2.

Most of the water courses are affected by the tide. The average tidal range is 1m - 1.5m on the main canals and 0.5m - 1m on the secondary canals. The tidal currents have the advantage of maintaining or increasing depth at the beginning of canals. However, canal sections where two currents from the two main water courses meet may silt up and have to be dredged regularly. The government now programs about 4 million cubic meters per year for the maintenance and clearing of canals and waterways.

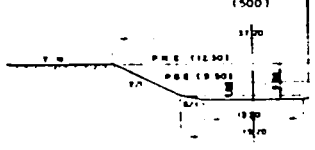
The waterways are also restricted to a certain extent by bridge clearances and this factor must be taken into consideration in the design of all vessels used on the waterways. The principal bridges are shown in Exhibit #3.

PRINCIPAL WATERWAYS OF SOUTH VIET-NAM

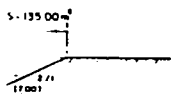
CANAL DE DERIVATION



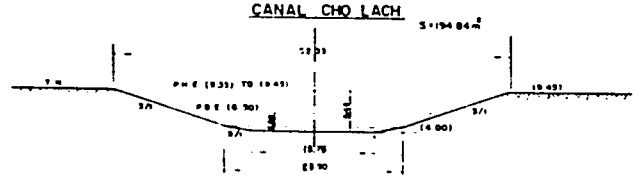
CANAL LONG-MY



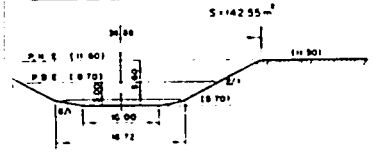
SSAC



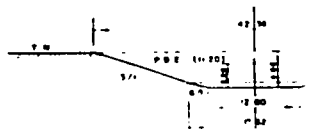
CANAL CHO LACH



CANAL CAY KHO



CANAL QUAN-LO PHU



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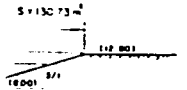

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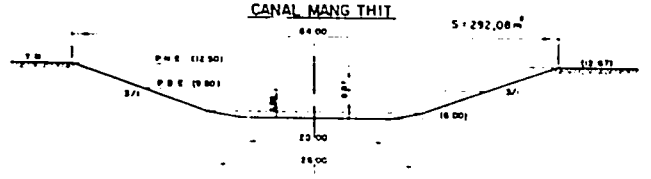
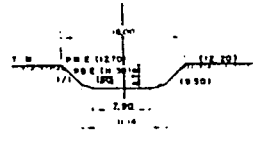
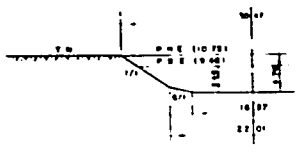
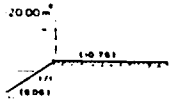


CANAL NUOC MAN

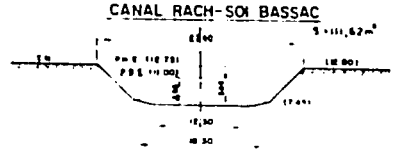


SONG BAY-H

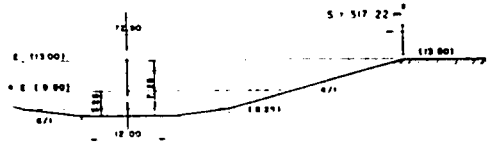




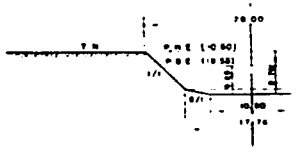
CANAL RACH-SOI BASSAC



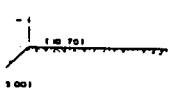
CANAL CHO-GAO



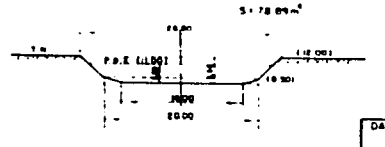
CANAL NAM-CAI



HAP



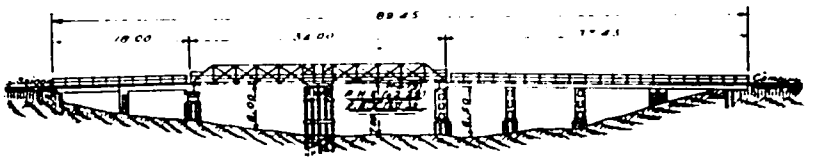
CANAL HA-TIEN RACH-GIA



DANIEL, MANN, JOHNSON, & MENDENHALL VIETNAM PORTS STUDY	
USOM/PWD	CONTRACT AID 430-990
TUG AND BARGE CONSTR. PROGRAM	
TYPICAL WATERWAY CROSS-SECTIONS	
BY D A WALSH	DATE JUNE, 1965

PRINCIPAL WATERWAY BRIDGES OF SOUTH VIET-NAM

CẦU PHỤNG-HIỆP
(SIÊU HẬU-GIANG LONG-MỸ)
TỶ-LỆ: 1/800



CẦU RẠCH MANG THÍT
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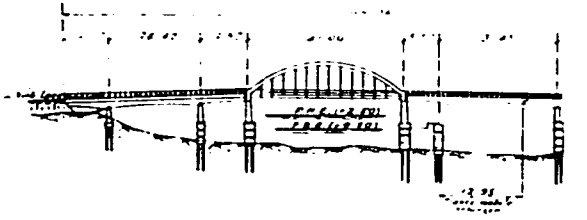

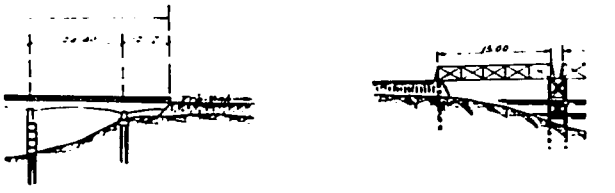

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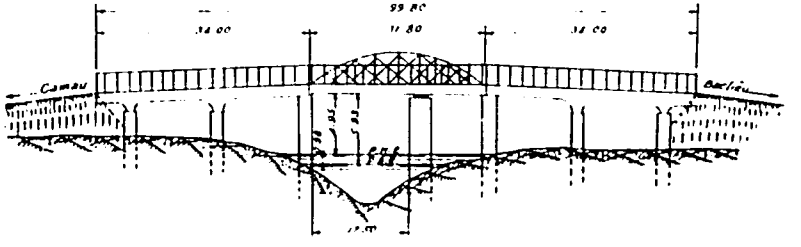

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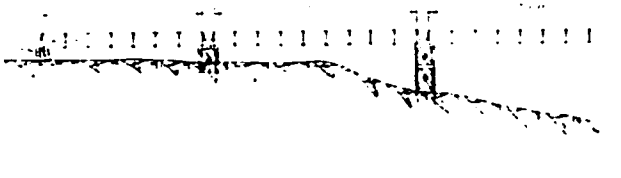

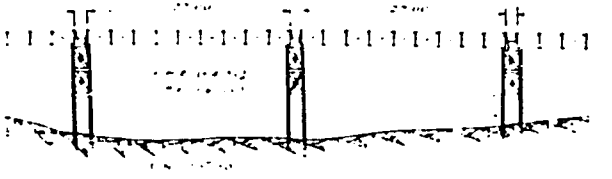

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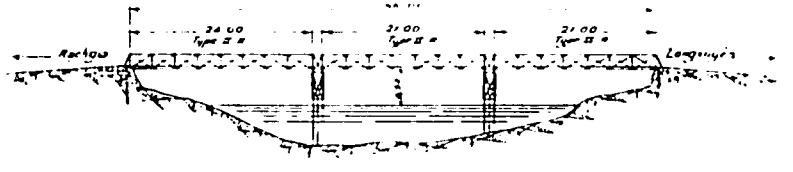

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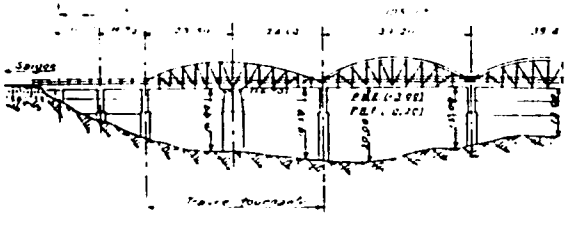


CẦU RẠCH BA
TỶ LỆ: 1

Waterway Transport

With such an extensive system of navigable waterways, a wide variety of craft of all types are used in South Viet-Nam ranging from small sampans with paddles or an outboard motor to heavy junks of up to 400 tons. The categories of craft of primary interest insofar as this study is concerned are those which are capable of assisting in the transportation of commercial cargo on the waterways. This, of course, includes sampans, motor launches, tugs, wooden junks, steel barges and lighters. Some of the more typical types of small craft used primarily for living quarters are shown in Figures 1 and 2.

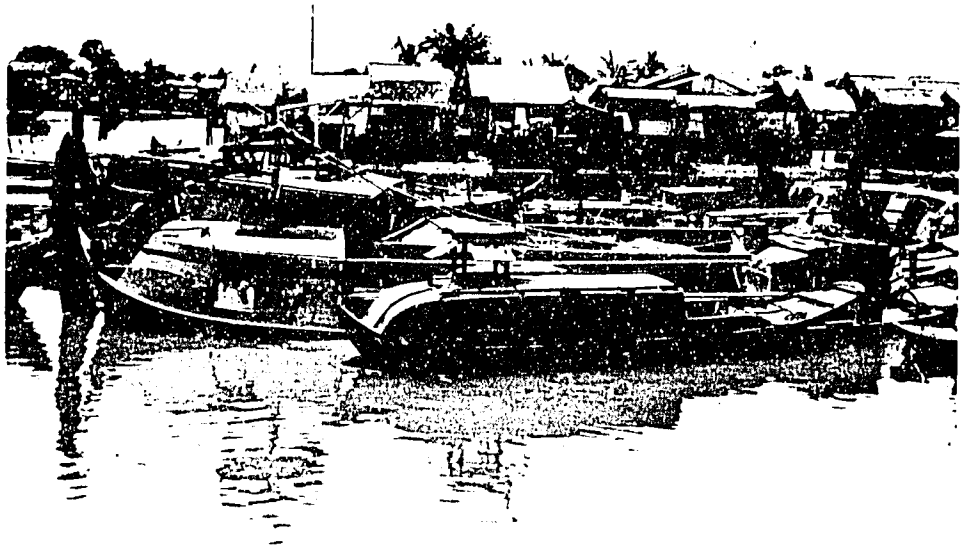


Figure 1 Small river craft on Saigon Canals

Sampans are the most numerous of all types of water craft seen in Viet-Nam. They not only serve for transporting rice and other cargo, but they also serve as a home for a family who lives aboard the Sampan. The size of sampans vary and often times the terms junk and sampan are used interchangeably. In general, however, the sampans are usually distinguished by their smaller size and low flat silhouttes. They ride quite low in the water and have a cargo carrying capacity on the order of from one to five tons. They can be propelled by paddles or by poles, but many have motors installed in them.

Launches which between the last two major wars competed with the railways and highways for goods and passenger transport are beginning to disappear with the improvement of the road system. Trucks can offer better service and have a higher factor of safety for cargo then the launches are capable of providing. Motor sampans are now replacing launches for transporting goods and passengers over short distances: At one time, the number of registered launches was about 1500, with a cargo capacity of about 7700 tons. This fleet is depleted to where only a minor portion of this number still remains in service.

It is difficult to classify and describe the launches, but in general, their size is between a sampan and the smaller junks. Also, most of the launches have metal hulls whereas the junks and sampans have wooden hulls.

Figure 2 Sampans and junks used for living quarters on Saigon canals

Junks are generally used for carrying rice and paddy. They are usually built of SAO wood, which is a particular local species, hard enough to resist ship-worm (toredo navalis.) Their numbers are declining because of the shortage of timber and skilled labor, the latter being a consequence of the former.

The following table gives typical dimensions and crew for the various sizes of junks used in South Viet-Nam:

Carrying Capacity Tons	Length M	Width M	Overall Height (Loaded) M	Loaded Draft M	Crew
20	13	4	1.35	1.05	3
50	20	5.5	1.6	1.30	3
100	24	6.5	2	1.65	4
200	29	7	2.6	2.25	5
250	30	8	2.8	2.45	7
330	32	8.5	2.35	3	9

Additional information on the junk fleet is given elsewhere in this report, but Figures 3, 4, 5 and 6 present adequate description relative to the physical features of junks.

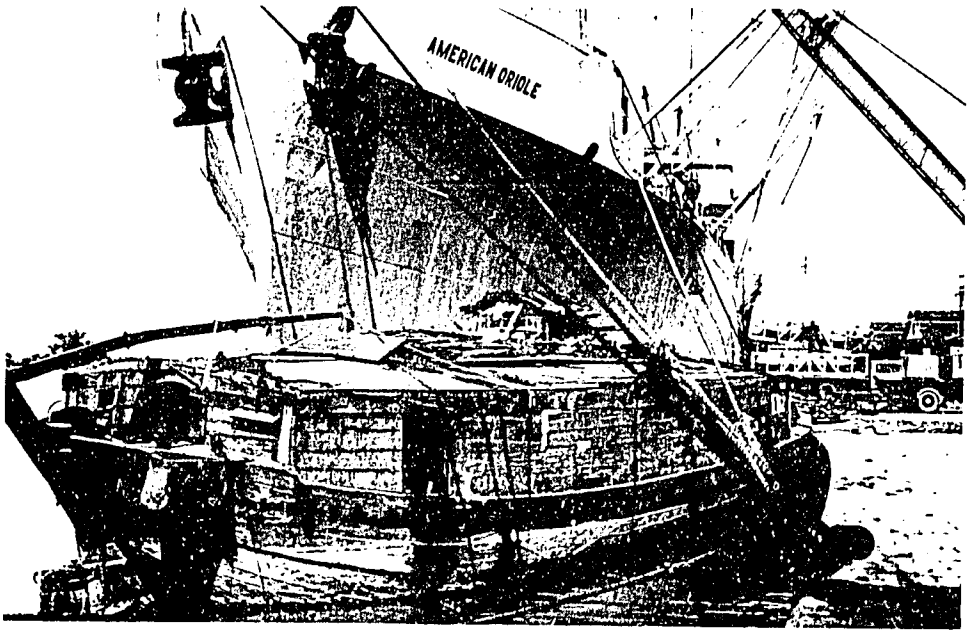


Figure 3 Typical Junk at Berth K-5, Saigon

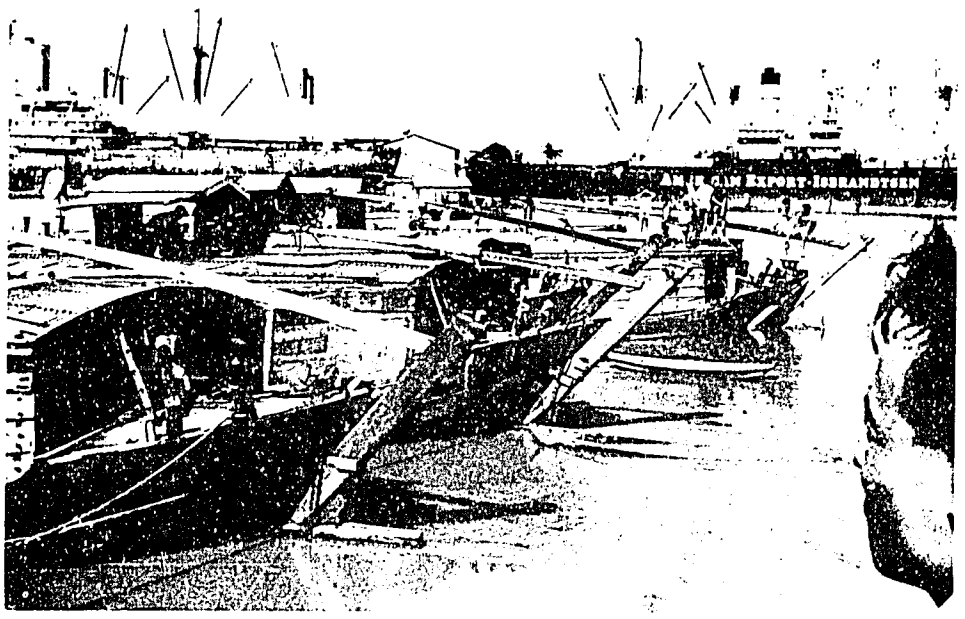


Figure 4 Junks tied up to Buoy on Saigon River showing crew's family living quarters on stern

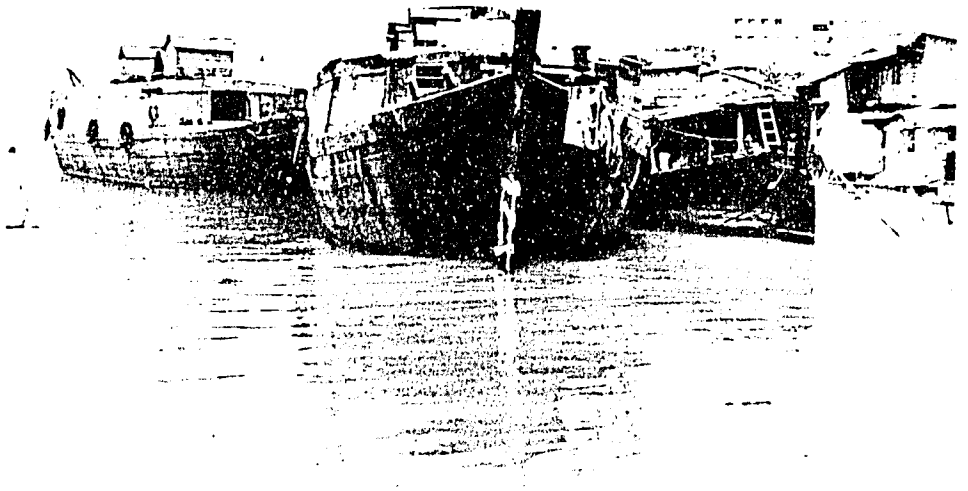


Figure 5 Junks tied up along river banks at Cholon

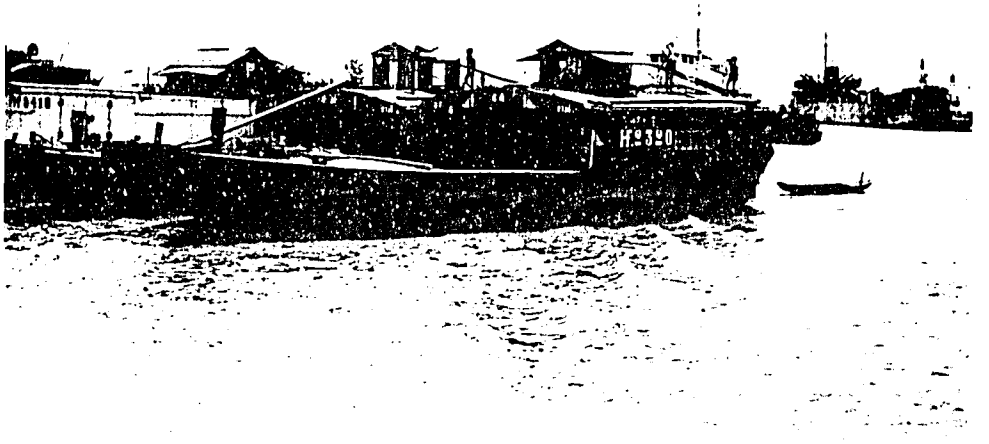


Figure 6 Junks tied up at Nha Be on Saigon River

Tugs are used quite extensively on the waterways of Viet-Nam for towing junks and barges. They vary in size and horsepower, with the larger tugs being stationed in Saigon to assist in the berthing of ships and for multiple tandem tows. The statistics on the number of tugs in service is quite misleading as almost any vessel that does not itself haul cargo, but has a motor is classified as a tug. Figures 7, 8, 9, and 10 show typical tug operations on the Saigon River.

Barges presently in use in Viet-Nam are mostly steel dumb barges of about 150 ton capacity. Many stevedoring firms as well as shipping companies rent their barges from the commercial Port of Saigon. Junks are used also as barges, but their number is rapidly decreasing. For that

matter, however, so are the number of steel barges. The oil companies own their own fuel oil barges and there are other owners such as the Ha Tien Cement Company which constructs their own special type of clinker barge.

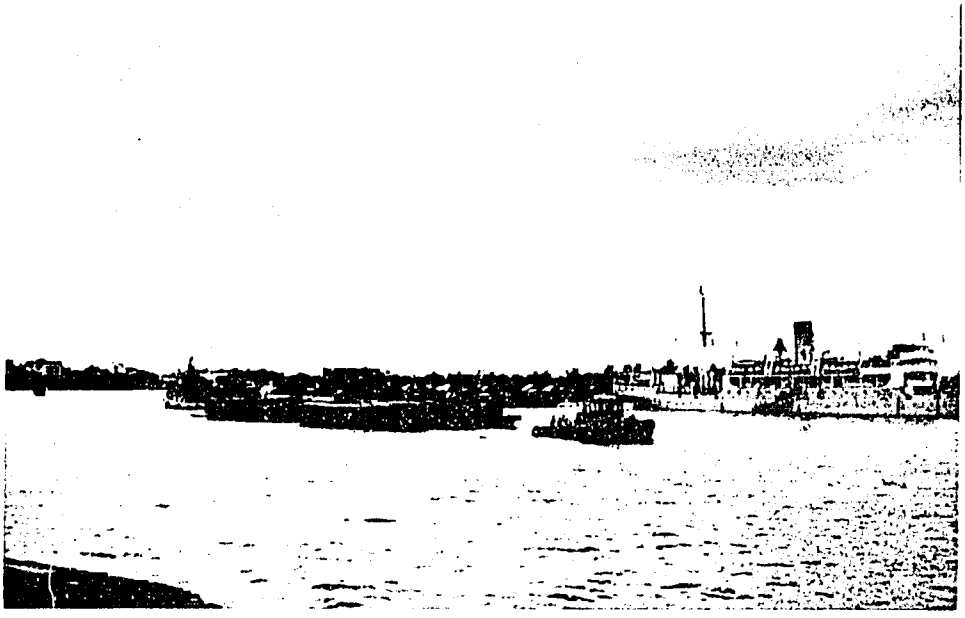


Figure 7 Small river tug with junks in tow

In this report, barges are distinguished from lighters. The differentiation being that barges transport cargo from port to port or from dock to dock, whereas lighters are considered as more of a ship-to-shore operation or vice-versa. It is difficult to arrive at a realistic inventory of barges in use in Viet-Nam as the registration rolls ar out of date and many sunken or lost barges are carried in the records as though they are still in service. It is the junk fleet, however, which carries the bulk of

cargo on the inland waterway system at the present time, with the exception of oil and special cargos.

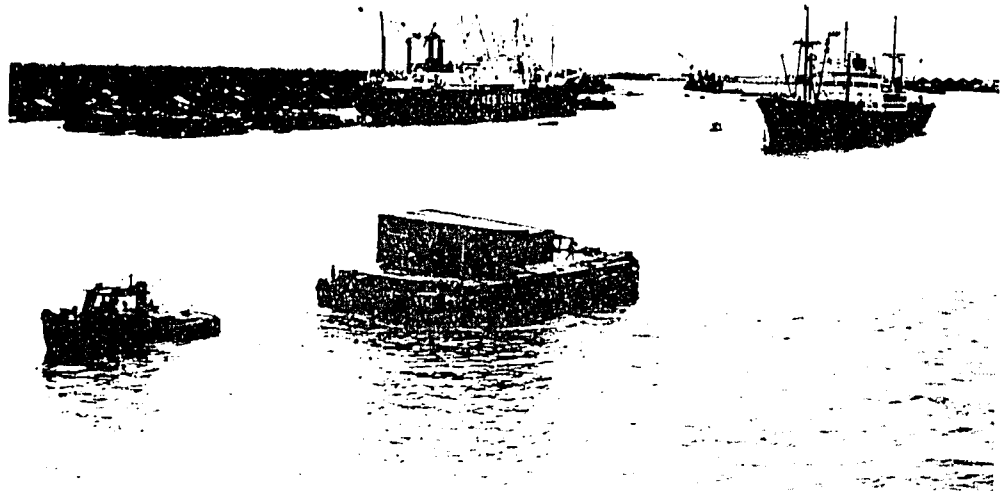


Figure 8 Small river tug with two barge units in tow with temporary connecting platform for wide load

Lighters are not differentiated from barges in the statistics of the various governmental agencies and users in Viet-Nam. All barges, whether used for lightering or not are classified as either dumb barges or powered barges. In the terminology of the study, however, lighters are classified as such.

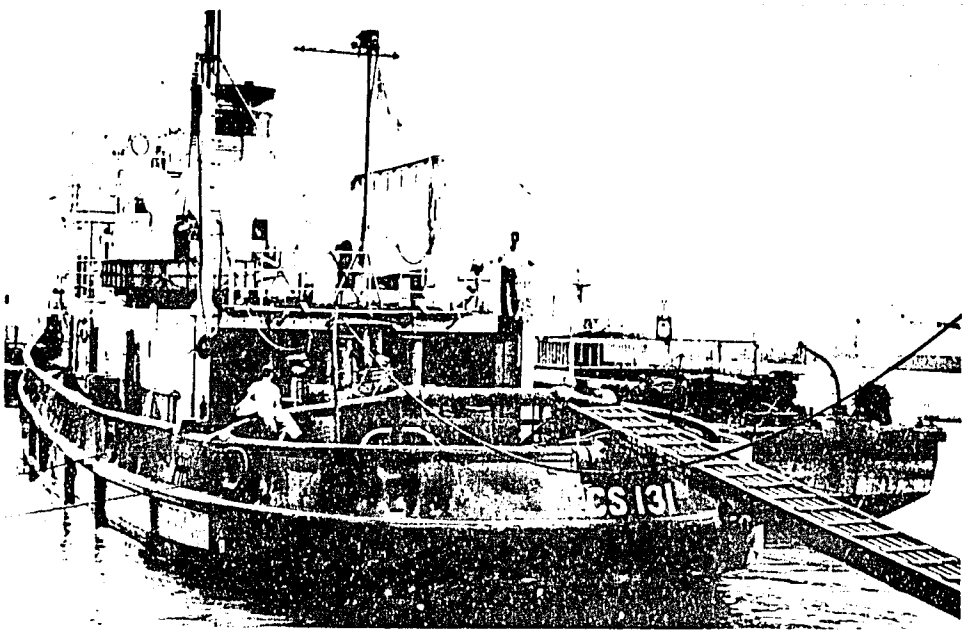


Figure 9 - 1,200 H. P. tug with seagoing 150 ton barge alongside

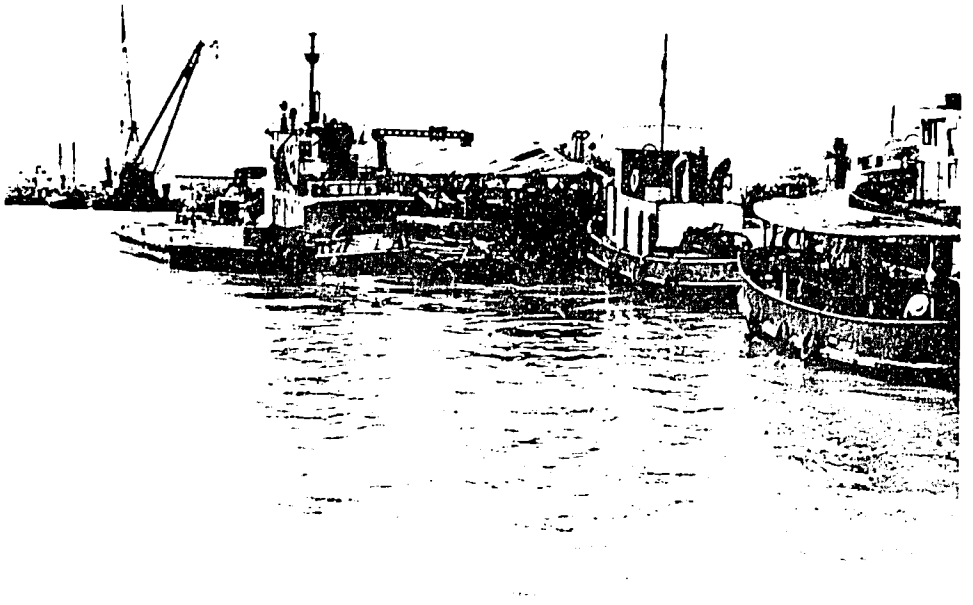


Figure 10 - Small river tugs - Saigon River

As a matter of general information, the following statistical information was taken from the "United Nations Economic Commission for Asia and the Far East, Cambodia, Laos, Thailand, and the Republic of Viet-Nam, Committee for Coordination of Investigations of Mekong Basin, Twenty-second Session (Special 21-24 Nov., 1963) at Saigon, Viet-Nam".

STEAM VESSELS

	1939	1954	1959	1962
Number	136	23	29	26 (1)
Tonnage	-	-	800 T	650 T
Engine Power	5,200 hp	2,260 hp	3,250 hp	2,840 hp

MOTOR VESSELS

	1939	1954	1959	1962
Number	392	49	1,490	2,643 (2)
Tonnage	-	-	29,310 T	39,100 T
Engine Power	14,200 hp	1,690 hp	56,370 hp	72,800 hp

BARGES AND JUNKS

	1939	1954	1959	1962
Number	3,823	749	923	1,020 (3)
Tonnage	285,200 T	86,190 T	105,600 T	100,500 T

NOTE: The above figures are from the river craft mortgage lists. The figures given by the Supervisory Commission are as follows:

1) Steam vessels in service:

Only four in service (124 tons, 480 hp); the other 22 were withdrawn long ago and are being dismantled.

2) Motor vessels in service: (excluding those belonging to oil companies)

a) Tugs 80 hp or over	41 (5,000 hp)
b) Powered barges and launches	13 (3,700 tons)
c) Powered junks 100 tons or over	150 (25,000 tons)
d) Small motorboats used for small-scale interprovincial transport	1,503 (7,700 tons)

3) Junks and barges in service

Wooden junks	250 (3,700 tons)
Metal barges	9 (1,400 tons)

Neither of these lists appear to be realistic as to vessels presently in use, with the possible exception of the number or wooden junks.

III. MARINE CONSTRUCTION AND REPAIR FACILITIES IN VIET-NAM

When, and if, a tug and barge construction program is undertaken in Viet-Nam the local capability in Viet Nam for this type of work should certainly be given consideration. In view of this, a rather brief survey was made to determine what local facilities existed in Viet Nam for this type of work. The information on the various shipyards and shops which was obtained is as follows:

CARIC (Chantiers Ateliers Reunis D'Indochine)

17, Ben Bach Dang

Saigon, Viet-Nam

CARIC is by far the largest and most diversified ship-building and marine repair company in Viet-Nam. Their shops and other facilities are located on the left bank of the Saigon River, opposite the docks of the City of Saigon, as shown in Figure 11. It is managed by five French and Vietnamese engineers, and they have a labor force which varies from about 200 to 800 workmen. The Director General of CARIC is Mr. A. C. Decoust. The principal activities of CARIC are:

A. Ship-building in both steel and wood

B. Heavy boiler work, fabrication of oil tanks, steel chimneys and related items

C. General mechanical work on motors, pumps, valves, etc.

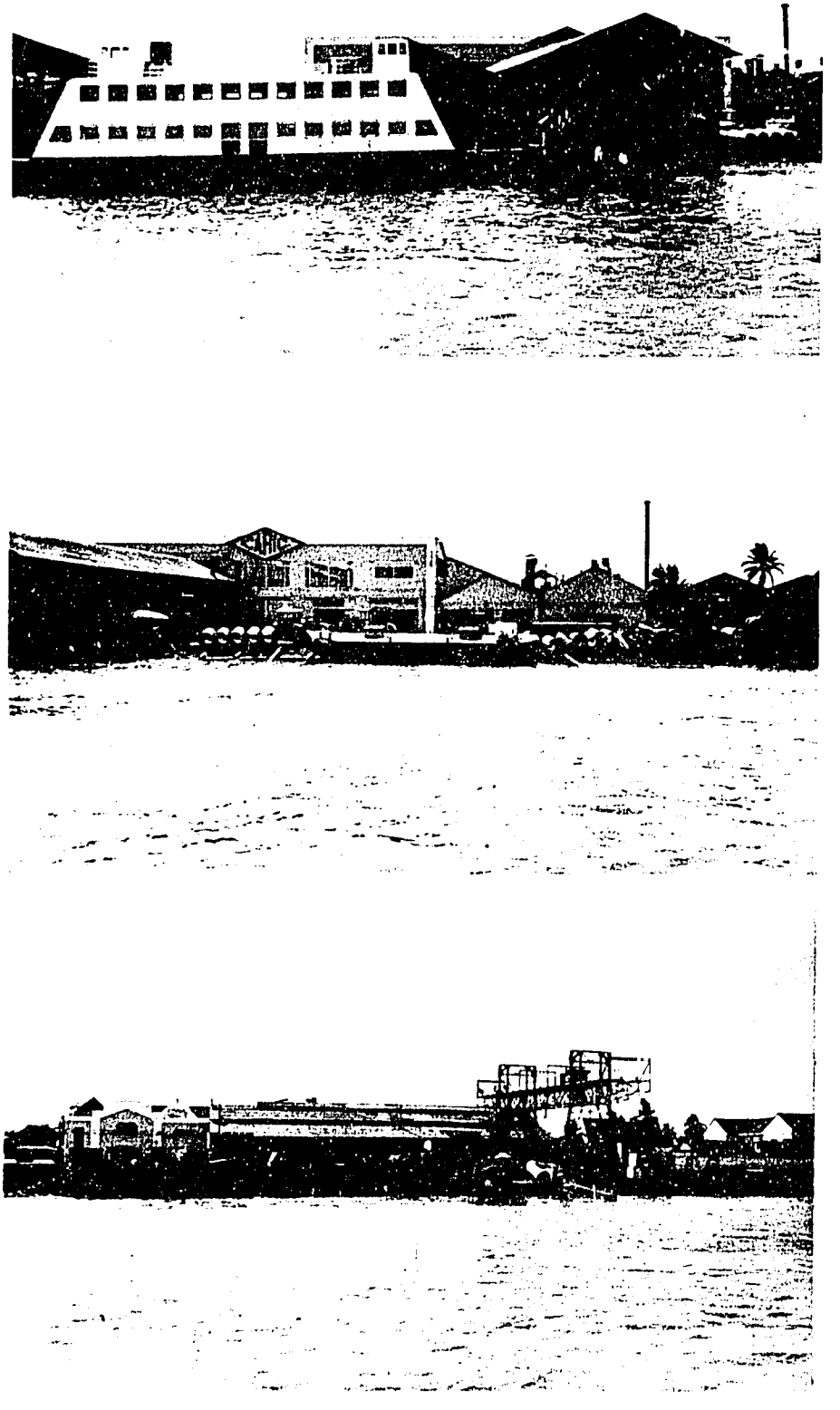


Figure 11. CARIC SHIPYARDS
Showing river ferry & steel barges under construction
Port of Saigon

D. Iron and steel castings

E. Structural iron and steel work

F. Installation and start-up of equipment and machinery they fabricate or for equipment imported through them, such as refrigerating plants, water works, rubber treatment plants, etc.

G. Ship and barge repairs, railroad equipment repairs, etc.

Figure 12. General View of Machine Shop.
Approximately eighty machine tools are working in this department.

The workshops and other facilities of CARIC consist of the following principal units: (See Figures 12 through 21)

A. Machine tool shops with horizontal and vertical semi-automatic lathes, boring, milling, slotting and planing machines, etc.

B. Iron, bronze, aluminum and steel foundry shops with a five-ton per hour cupola furnace and a one-ton per hour steel furnace.

C. Blacksmith shop and forge with presses and electric and heavy oil furnaces.

D. Plate and boiler shop with gate sheers, plate bending press, plate rolls, blanking and punching machines, etc.

E. Welding shop with automatic welding, flux welding, etc.

F. Sheet metal shop for the manufacture and repair of metal containers, drums, butane gas bottles, etc.

G. Electro-plating shop

H. Fabricating shop

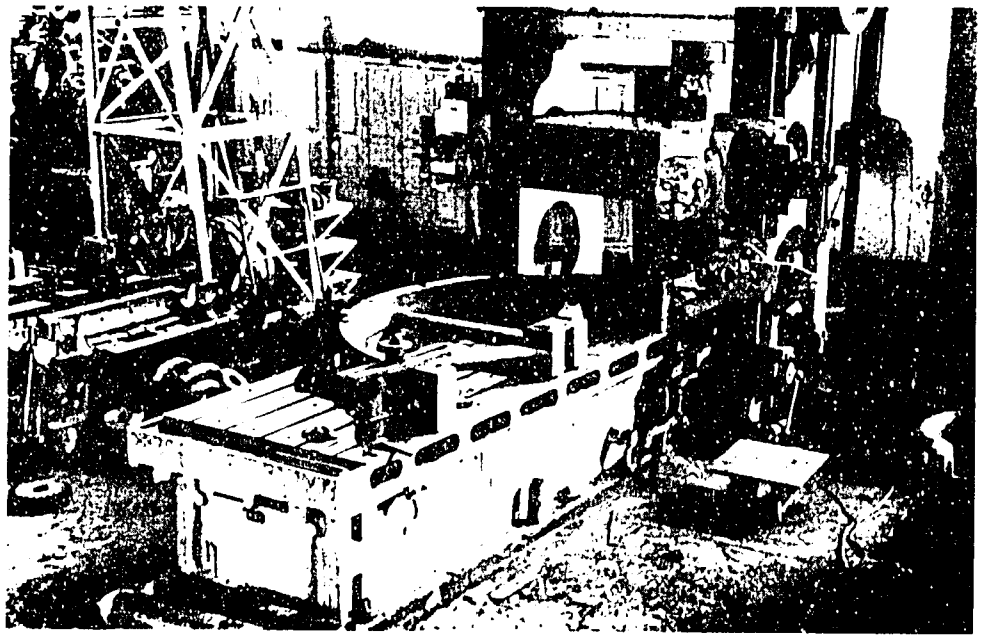


Figure 13. Planing machine in use.

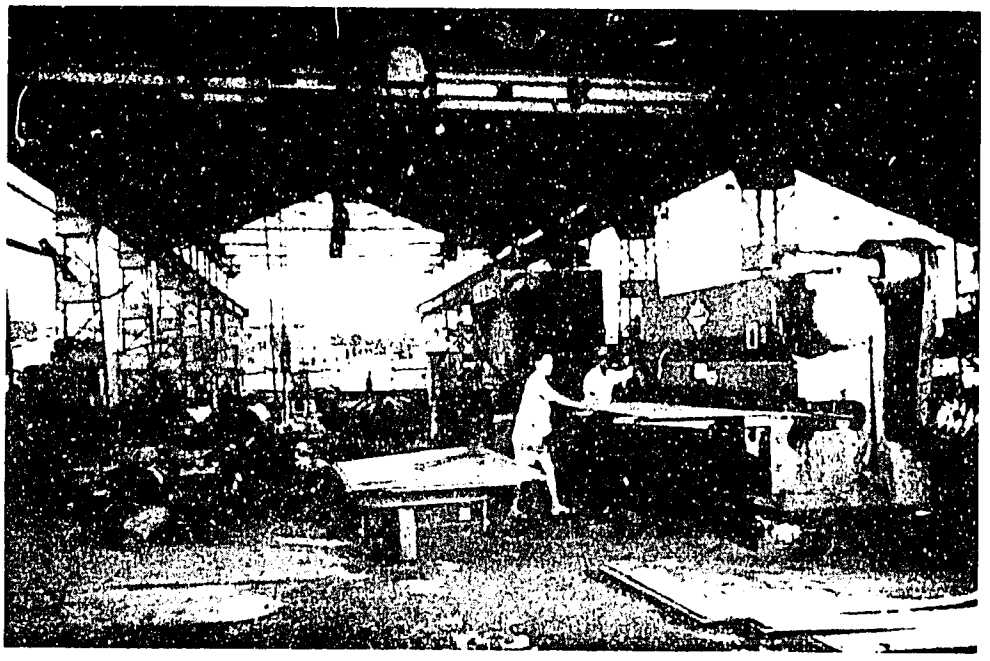


Figure 14. Cutting, bending, and folding machines in use.

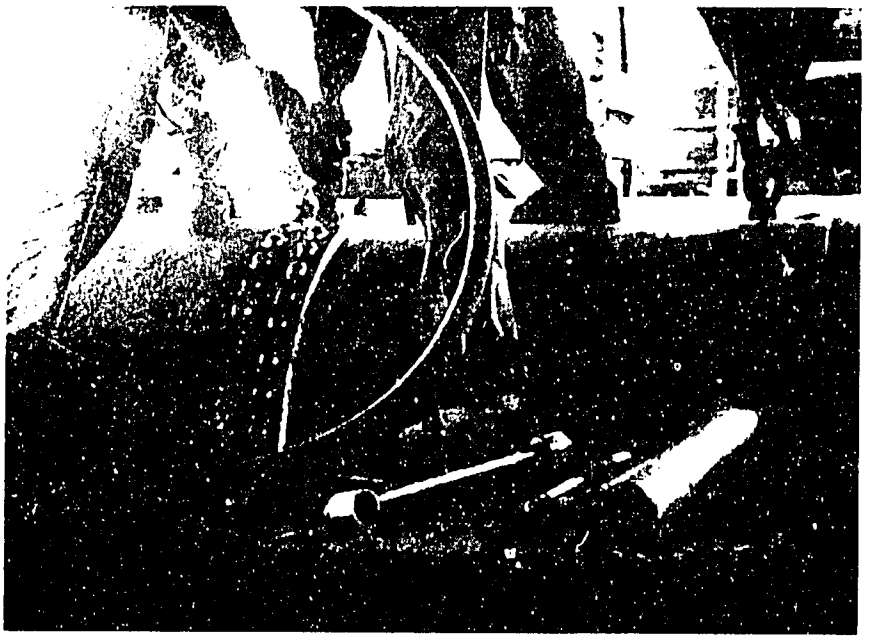


Figure 15. Riveting in Boiler Shop.

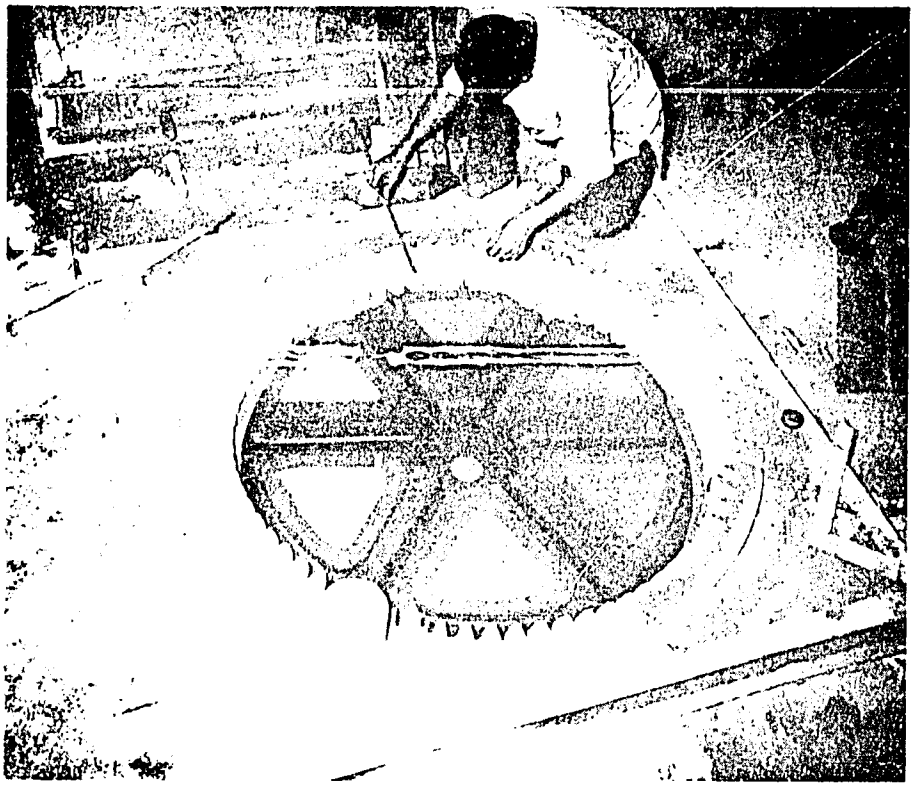


Figure 16. Mold for Gear Wheel.

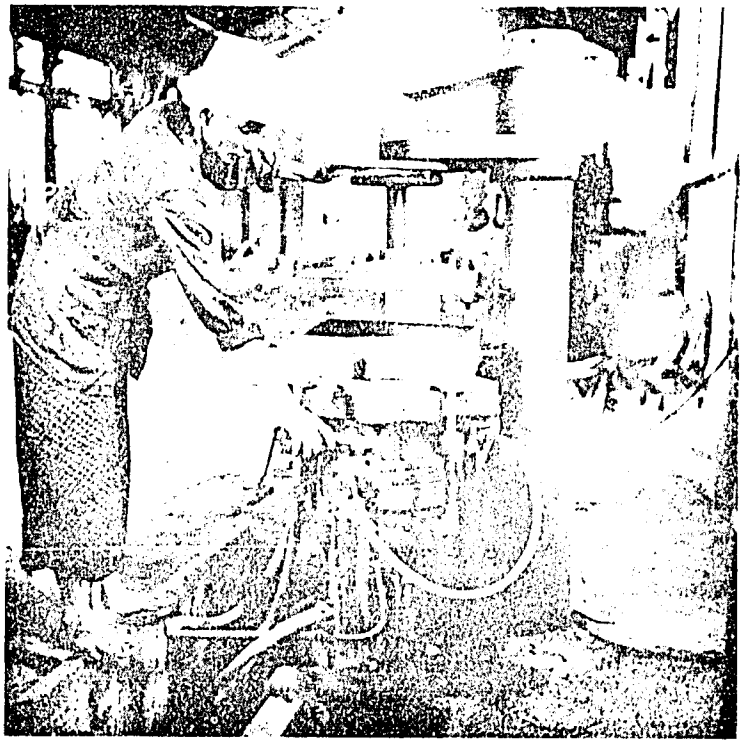


Figure 17. Plate Molding Machine.

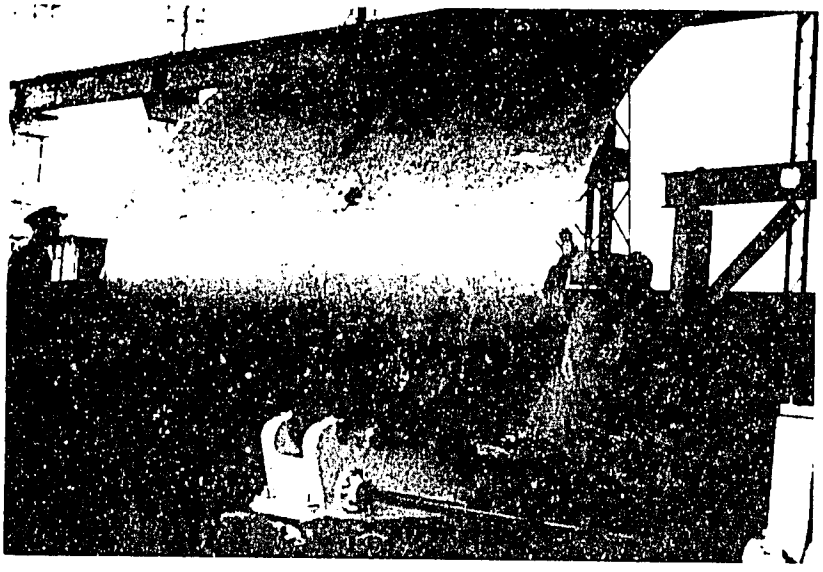


Figure 18. Plate bending rolls in operation.

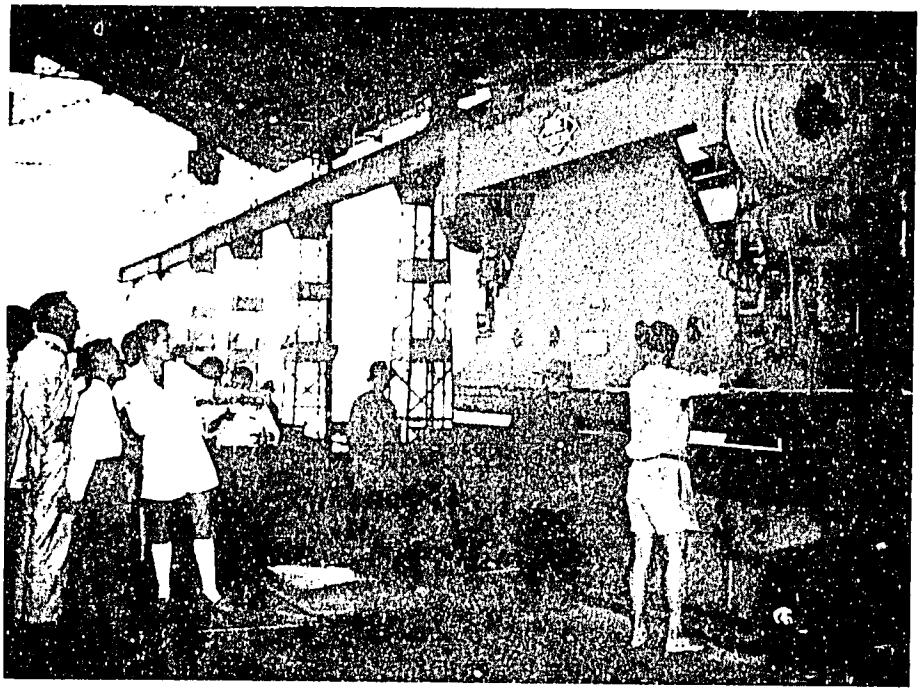


Figure 19. Plate shearing and crimping machine.

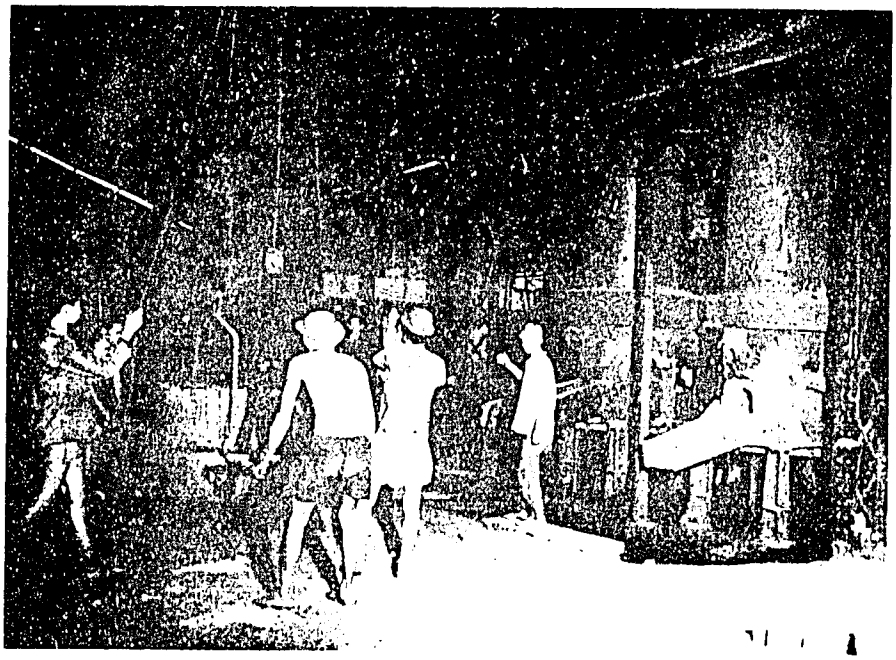


Figure 20. Cast Iron Foundry.

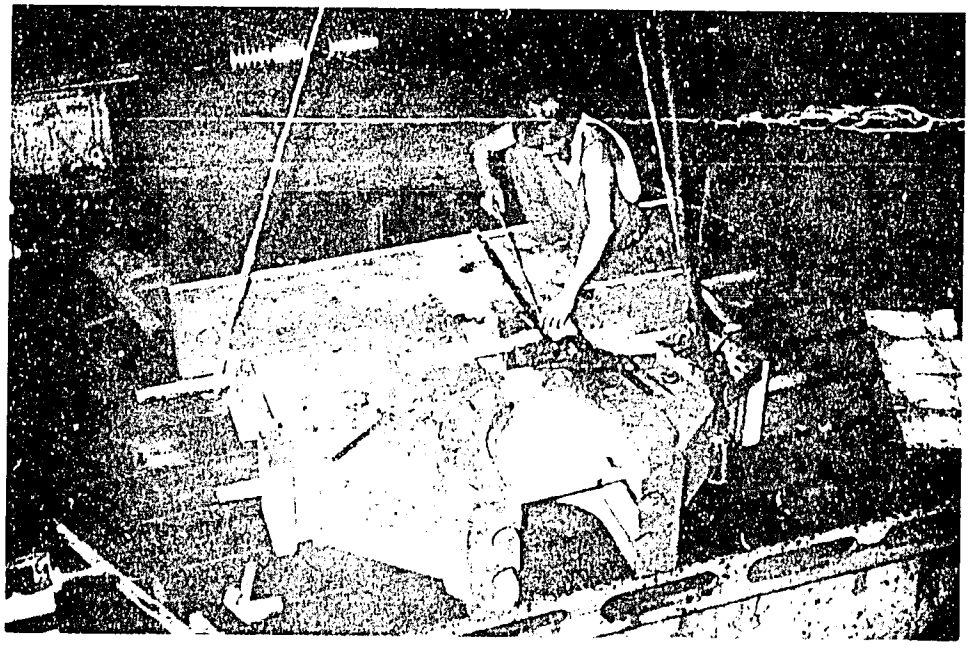


Figure 21. Cast iron frame for sugar mill machinery cast in CARIC Foundry (weight 9,000 lbs.).

In addition to the aforementioned shops and facilities, CARIC has two marine railways for repairing vessels and two shipbuilding ways. These shipbuilding and repair facilities can accommodate vessels up to 50 meters in length (164 feet), widths up to 15 meters (48 feet), and with displacements of up to 300 metric tons. The CARIC yards have a 1200 h. p. electric generator with which they satisfy their entire requirement for electric power. They also have a 150 h. p. compressed air plant.

The management of CARIC states that the capacity of their yard per year would be from 24 to 30 barges from 250 to 500 tons plus from 4 to 6 tugs of the intermediate h. p. class from 250 to 600 h. p. They indicate that for any extensive barge building program, it would take probably four months to build the first unit, and that they could be built thereafter at the rate of about three per month if all units are identical.

According to the CARIC Company, they have fabricated a considerable number of steel barges and the following listing indicates some of the larger ones as of May, 1965:

Plan I. D. No.	Tonnage or Type	Status
CHA 0. 124	100 tons	1 - constructed
CHA 0. 218	250 tons	design or planning
CHA 0. 093	240 tons - tanker	2 - constructed

Plan I.D. No.	Tonnage or Type	Status
CHA 0.263	200 tons - tanker	design or planning
C-D2	300 tons	7 - constructed
CHA 0.155	300 tons	1 - constructed
CHA 0.267	350 tons	design or planning
CHA 0.161	400 tons - tanker	1 - constructed
CHA 0.143	140 tons - tanker	3 - constructed
CHA 0.266	150 tons	4 - constructed
CHA 0.270	200 tons - tanker	design or planning
CHA 0.274	250 tons	design or planning
CHA 0.260	300 tons	2 - constructed

The following Figures 22 through 37 show not only the various types of marine craft fabricated by CARIC, but also show their shops and equipment and the diversity of the types of work in which they are engaged.

The impression one gets after visiting the CARIC shops and yards is that they are well organized, managed and equipped to undertake a sizeable tug and barge construction program without a major expansion of their facilities and labor force.

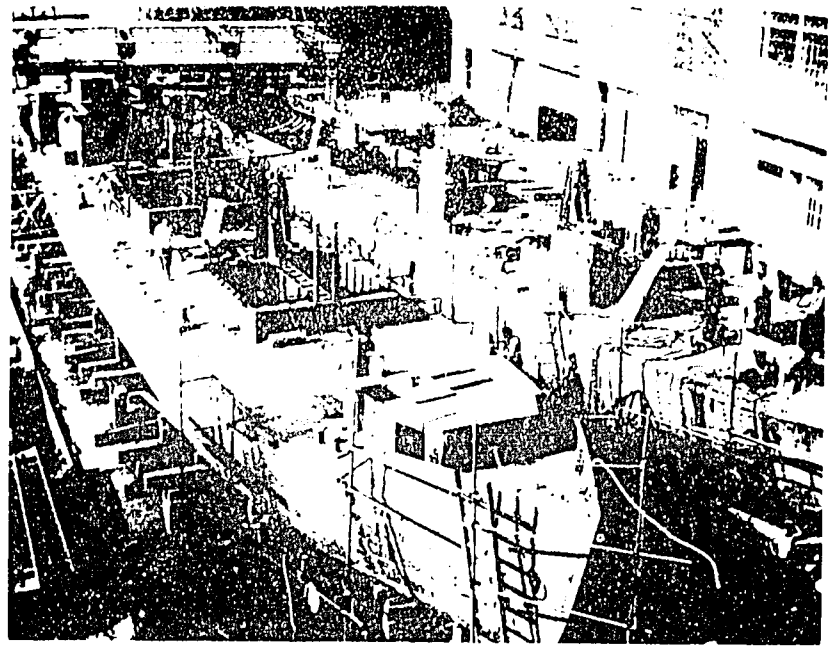


Figure 22. Shell Oil Company 200-ton tankers being built at CARIC shipyards in 1954.

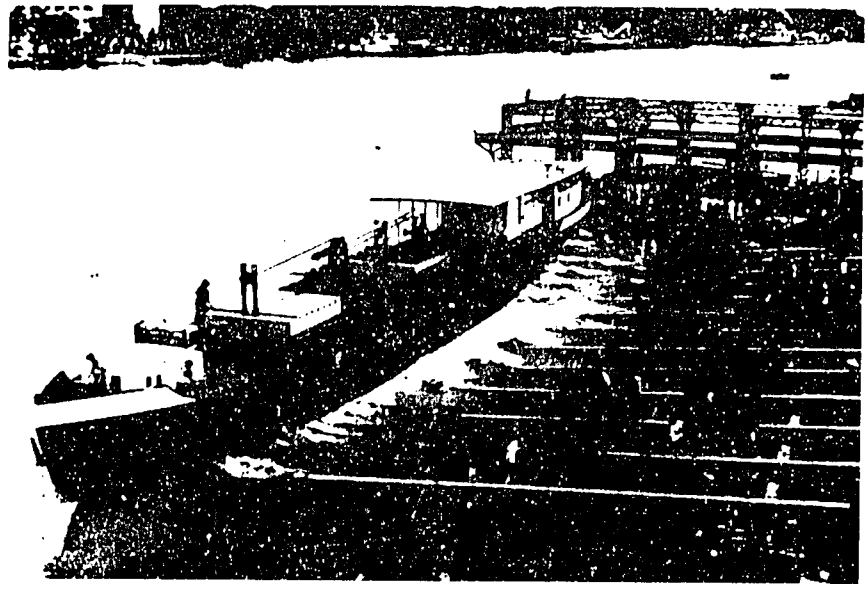


Figure 23. Launching of Shell Oil Company tanker.

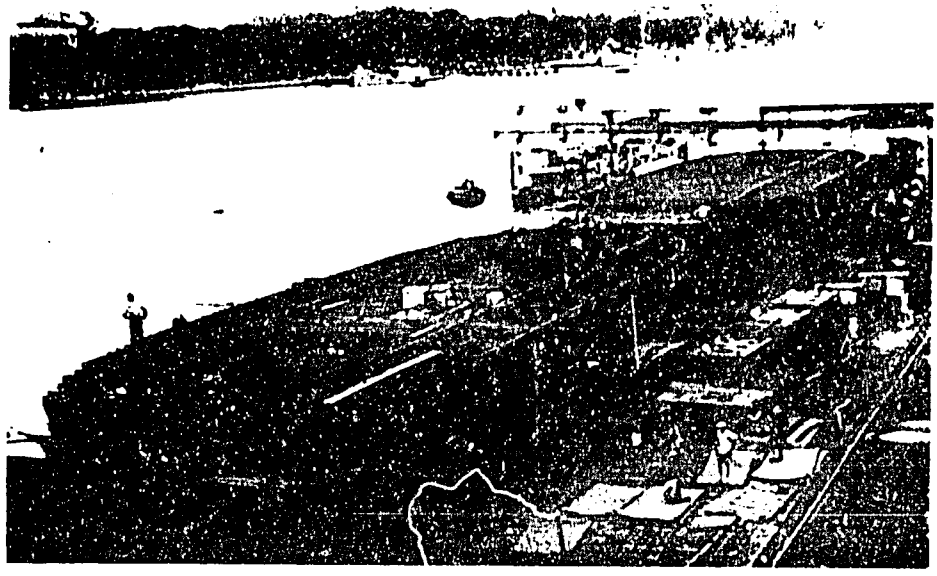


Figure 24. Saigon River ferry boats under construction at CARIC shipyards - 1960.

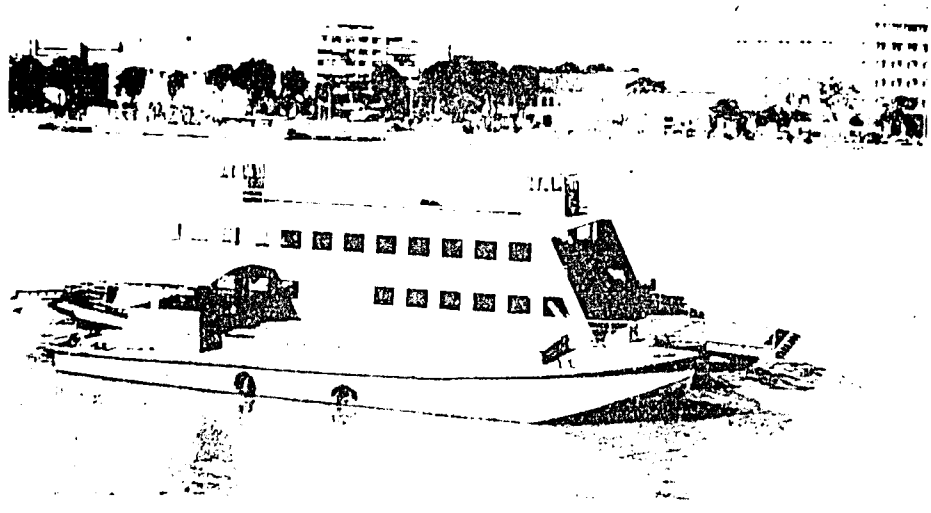


Figure 25. Saigon ferry in operation - 1961.

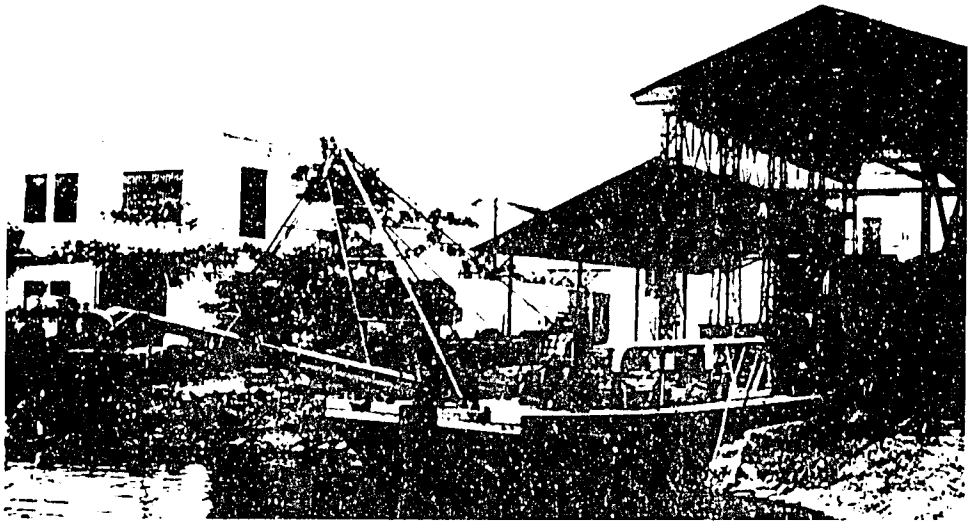


Figure 26. 8-inch suction dredge (built by CARIC in 1960).

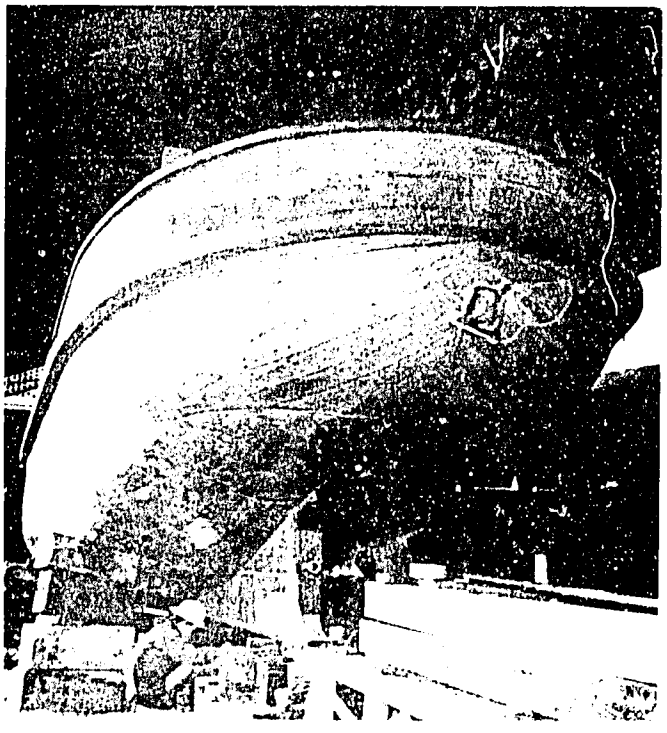


Figure 27. Wooden hull fishing boat (built by CARIC in 1959).

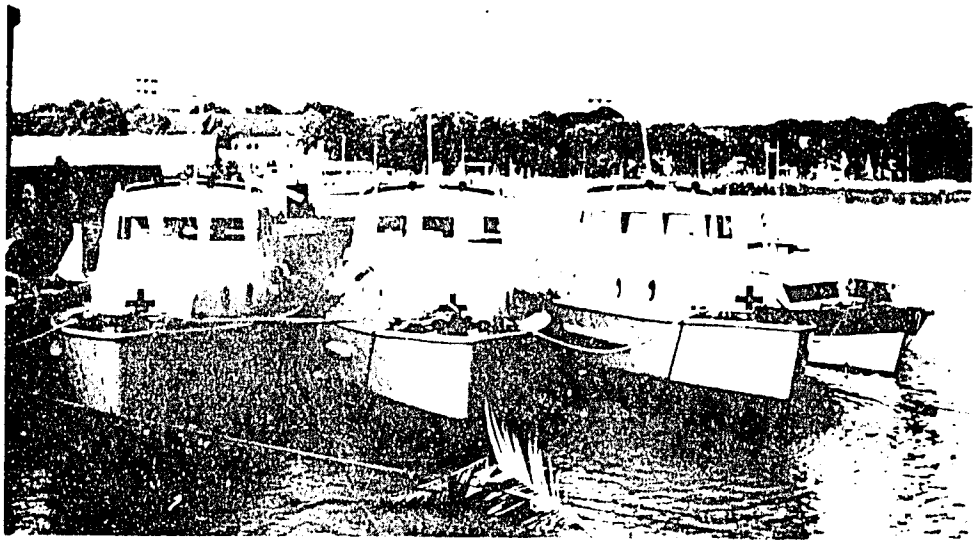


Figure 28. Small patrol boats for the Customs Service.
(Built by CARIC in 1959)

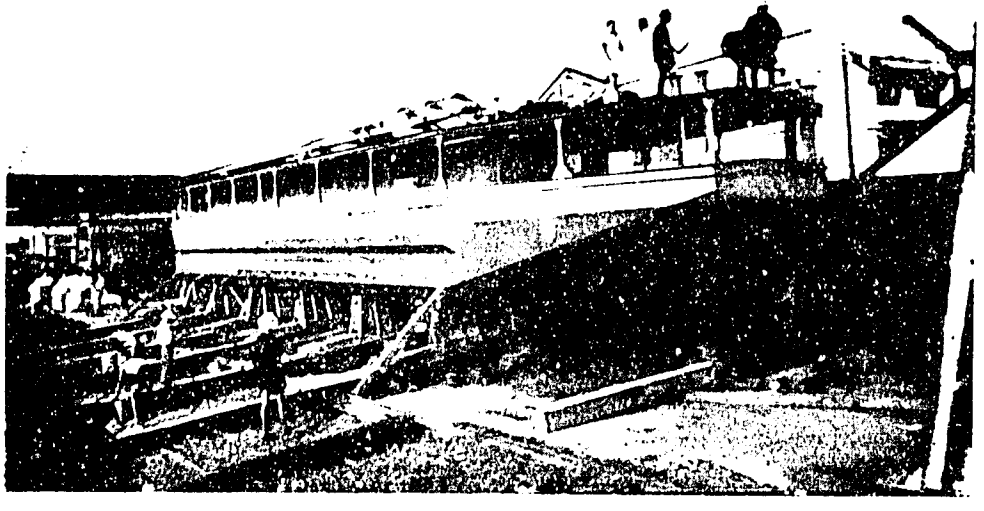


Figure 29. Tanker barge (3) of 140-ton capacity for hauling latex.
(Built by CARIC in 1959)

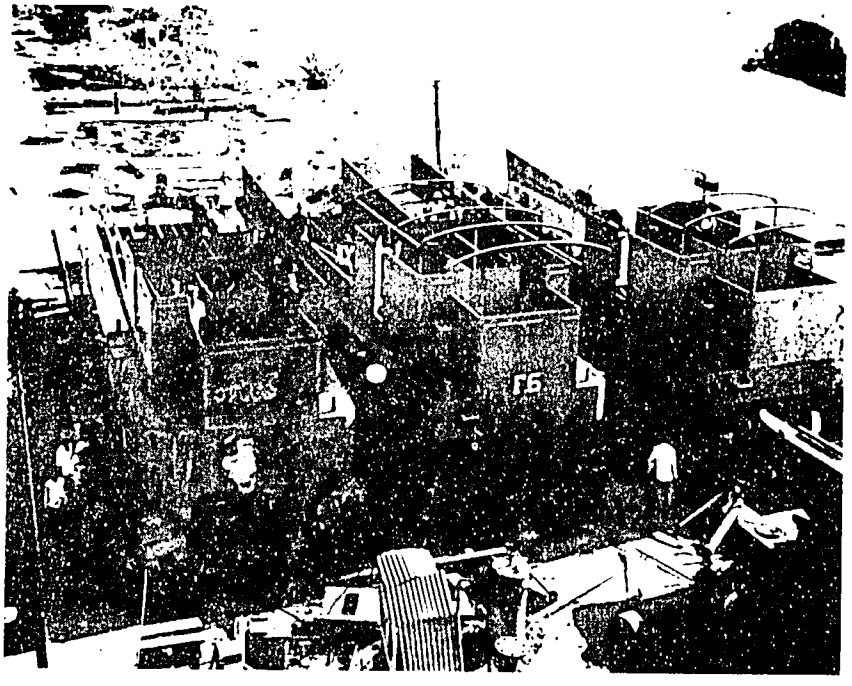


Figure 30. Fabricating landing craft - 1953.

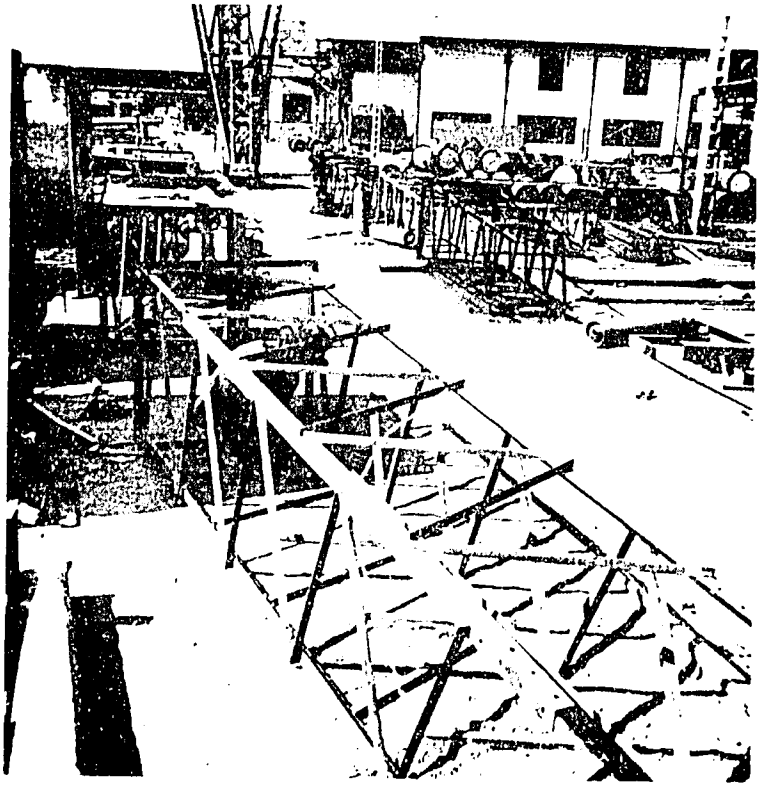


Figure 31. Fabrication of electric transmission tower pylons.

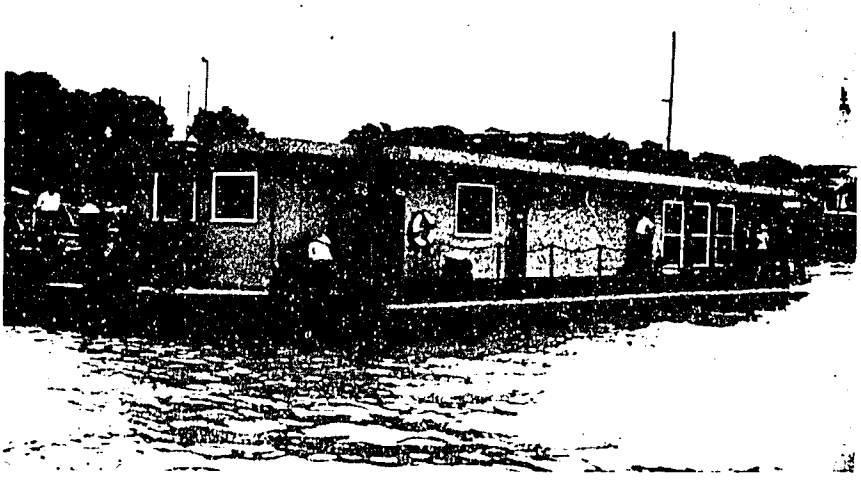


Figure 32. Hydrographic Survey House Boat. (Built by CARIC in 1960).

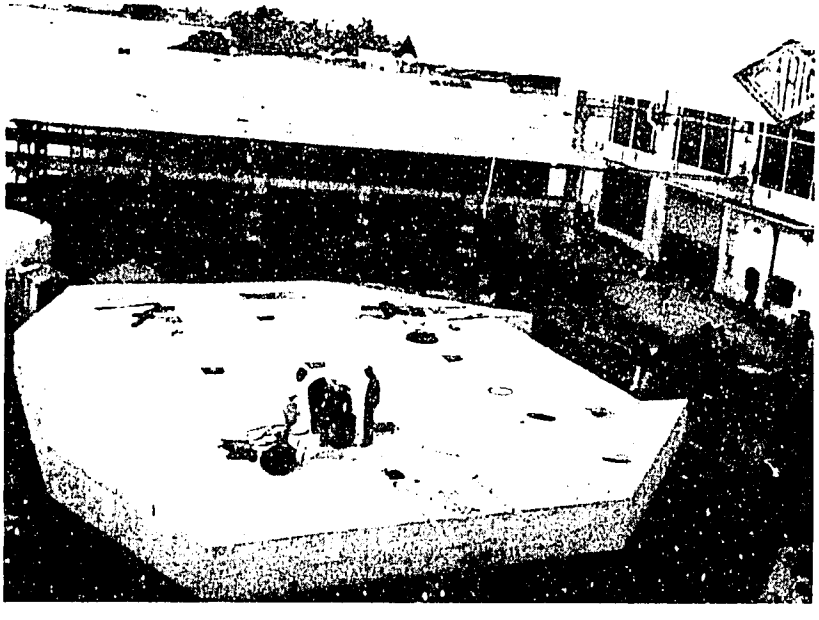


Figure 33. Floating dock being launched at CARIC shipyards - 1960.

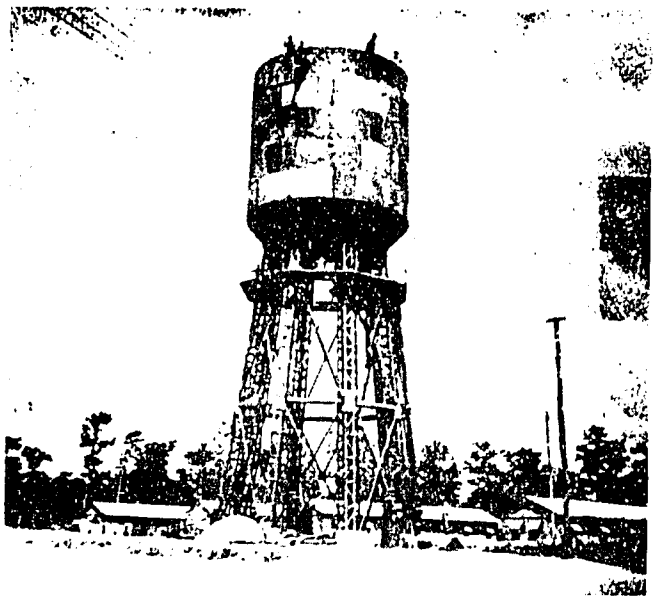


Figure 34. Elevated storage tank of 3,000-barrel capacity. (Built by CARIC in 1956)

Figure 35. Floating concrete dock under construction at CARIC Shipyards - 1960.

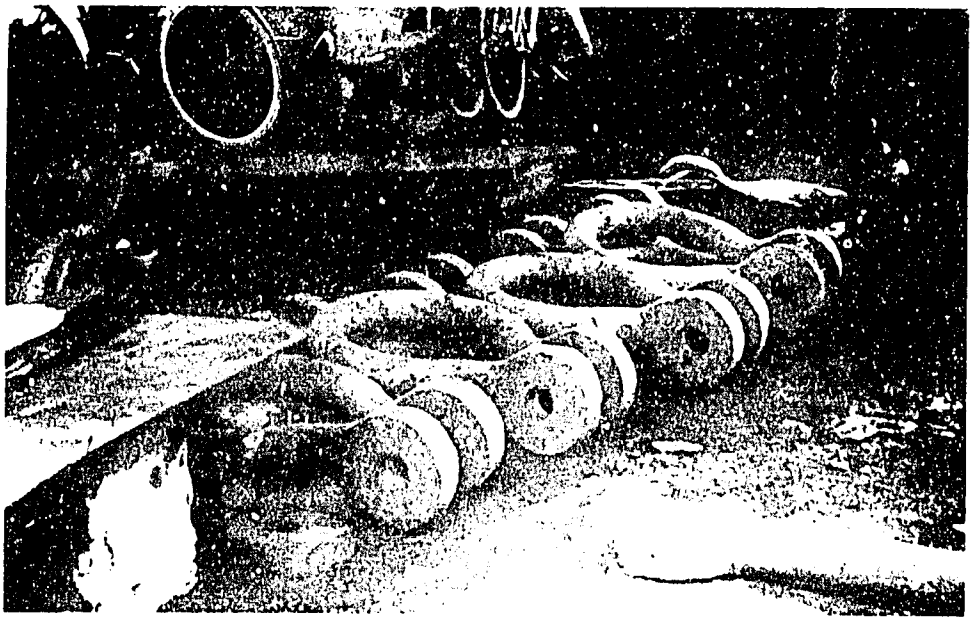


Figure 36. Boat shackles made at CARIC Shipyards.

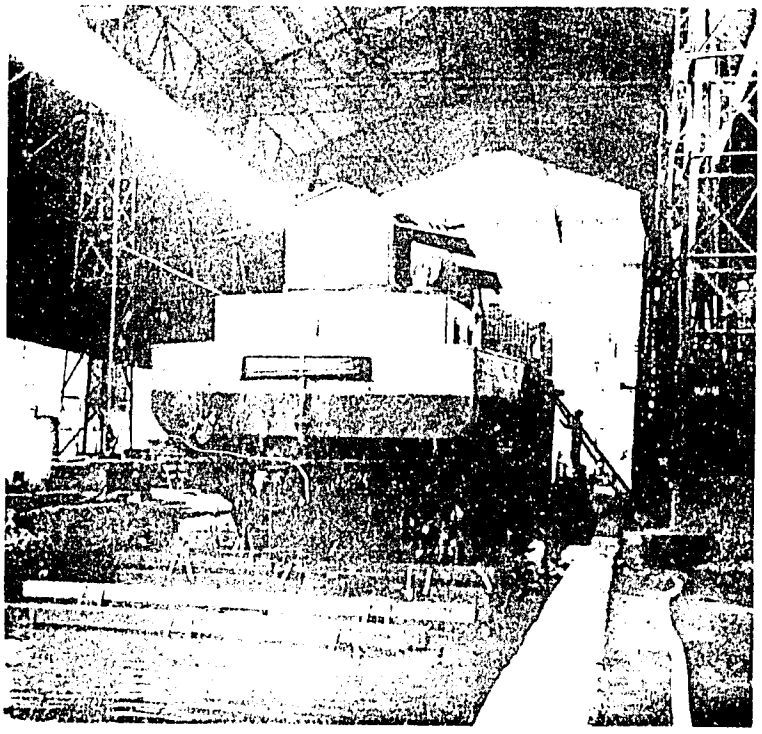


Figure 37. Painting barge hull on CARIC ship-way.

Enterprise De Constructions Metalliques
249 Duong Ton-Dan
Khanh-Hoi, Saigon Viet-Nam
(Manager: Hang Sat Hong Sung)

They have small machine and metal working shops but new and larger shops and facilities are now under construction. They have two graving docks for barge construction and can build up to six barges of varying sizes at one time. The layout of these graving docks is not too desirable from an operations standpoint as the larger of the two abutts on the smaller one on the inland side and is landlocked. Access to the larger graving dock is only possible by going through the smaller dock and out onto the Saigon River. This means that scheduling of fabrication and repair work must be handled in such a manner that the smaller graving dock can also be flooded when launching the barges constructed within the larger graving dock. A sketch layout of their yard and shops is shown in Exhibit 4.

This Company has built over a dozen of the clinker barges for the Ha Tien Cement Company. They estimate that if steel is available, they can complete the first barge of an extensive barge program within four months. After the first barge is built, succeeding ones can be built at the rate of one or two per month.

Their main items of equipment consist of cutting torches, welding machines, lathes, grinding wheels, metal working machines and small punch presses. They do not have a foundry. Normal work force is about 50; however, they can staff up to approximately 200 on short notice.

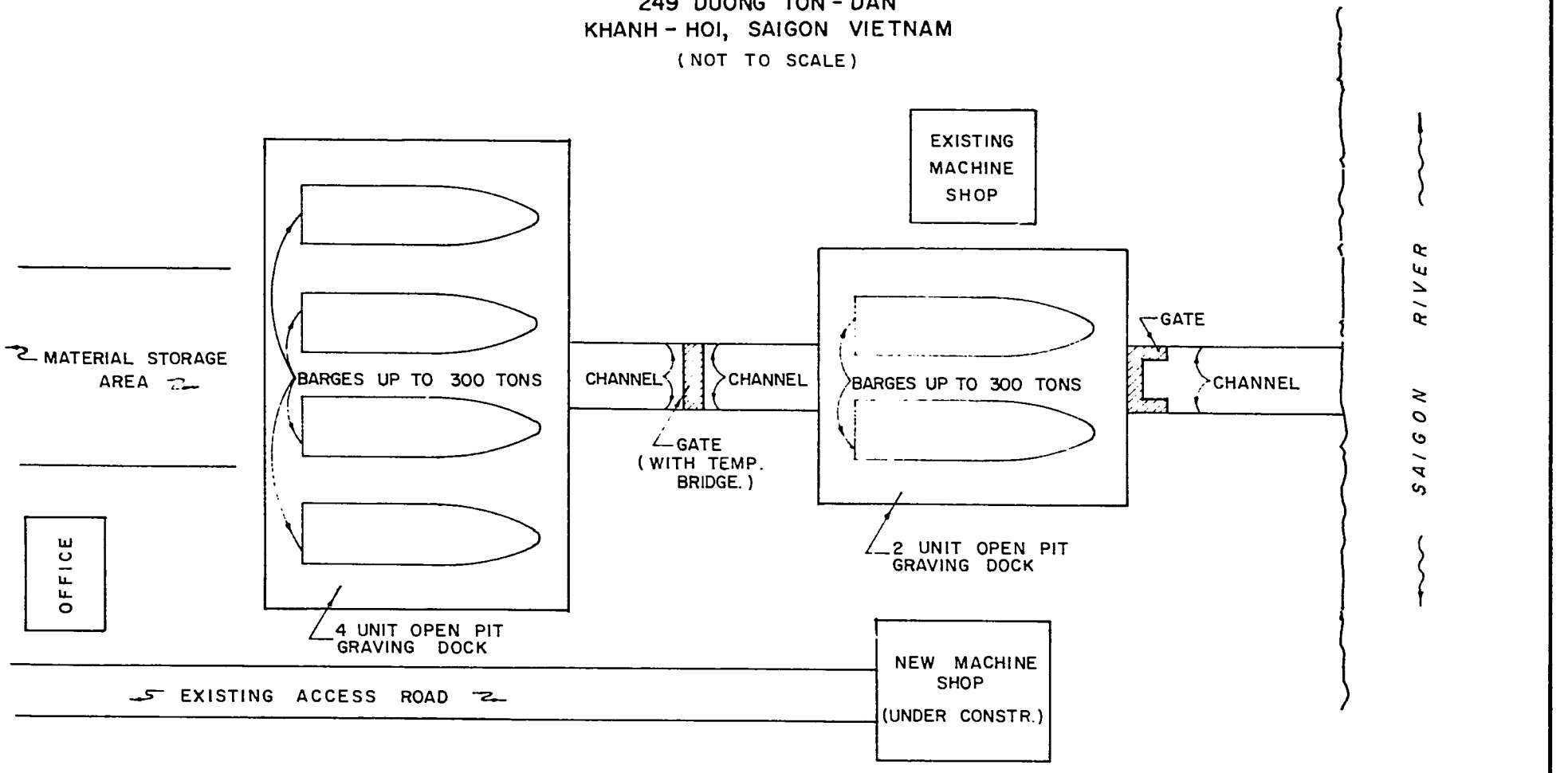
YARD LAYOUT

ENTERPRISE DE CONSTRUCTIONS METALLIQUES

249 DUONG TON - DAN

KHANH - HOI, SAIGON VIETNAM

(NOT TO SCALE)



DANIEL, MANN, JOHNSON, & MENDENHALL VIETNAM PORTS STUDY	
USOM / PW	CONTRACT - AID. 430 - 990
TUG AND BARGE CONSTR. PROGRAM	
ENTERPRISE DE CONSTR. METALLIQUES BARGE CONSTRUCTION FACILITIES	
BY D.A. WALSH	DATE JUNE, 1965

EXHIBIT # 4

EXHIBIT # 4

Pham Quang Khai
29 Yen Do,
Saigon, Viet-Nam

This is a rather small company which does not have too extensive an establishment in the way of shops and equipment. They do, however, do good quality work as evidenced by the photos shown in Figure 38. Their barge building ways are located right alongside the canal banks and the finished barge is launched directly into the canal. A layout sketch of their facilities is shown in Exhibit 5.

This company has built several barges of the 500-ton category. They work on more or less an intermittent basis as orders are received for fabrication work.

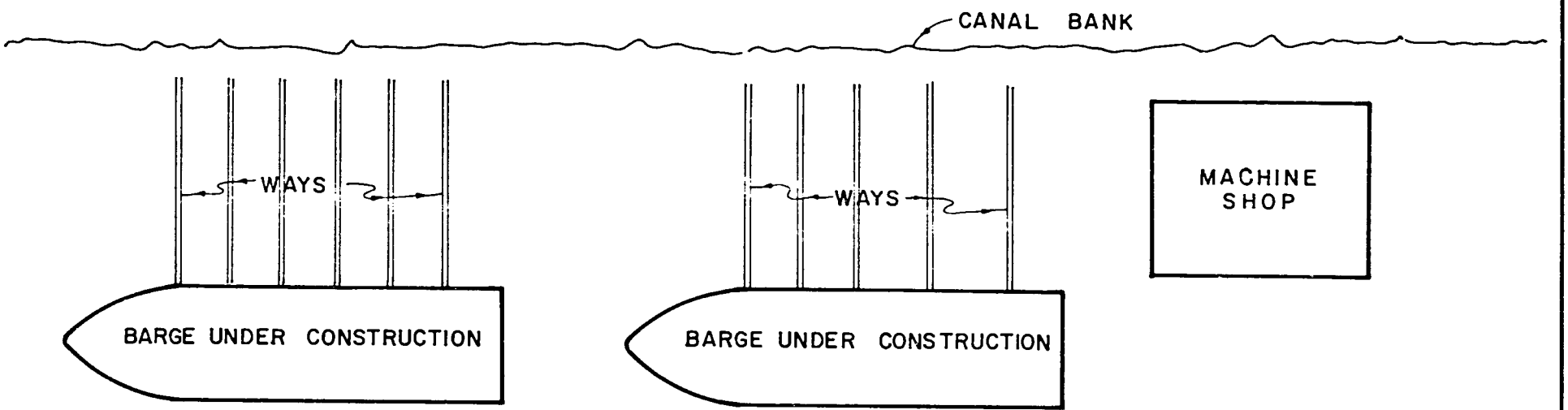
The three yards above noted constitute the principal barge and tug builders in the Saigon area. There are several other smaller yards along the canal banks that do repair work and fabrication of smaller marine and building structures.

The ASAM - Dong Nai Company operated by the Rotan Brothers is a steel fabrication shop with excellent facilities and machines, but they have never built barges. In fact, their shop is located on a small canal that dries at low water and is obstructed by low bridges. They could probably do some pre-cutting in their present shops and fabricate either at a more accessible location on the canal banks or out along the Saigon River.

YARD LAYOUT

PHAM QUANG KHAI
29 YEN DO, SAIGON VIETNAM

(NOT TO SCALE)



DANIEL, MANN, JOHNSON, & MENDENHALL VIETNAM PORTS STUDY	
USOM/PWD	CONTRACT - AID 430-990
TUG AND BARGE CONSTR. PROGRAM	
PHAM QUANG KHAI BARGE FABRICATION FACILITIES	
BY D.A. WALSH	DATE JUNE, 1965

EXHIBIT # 5

EXHIBIT #5

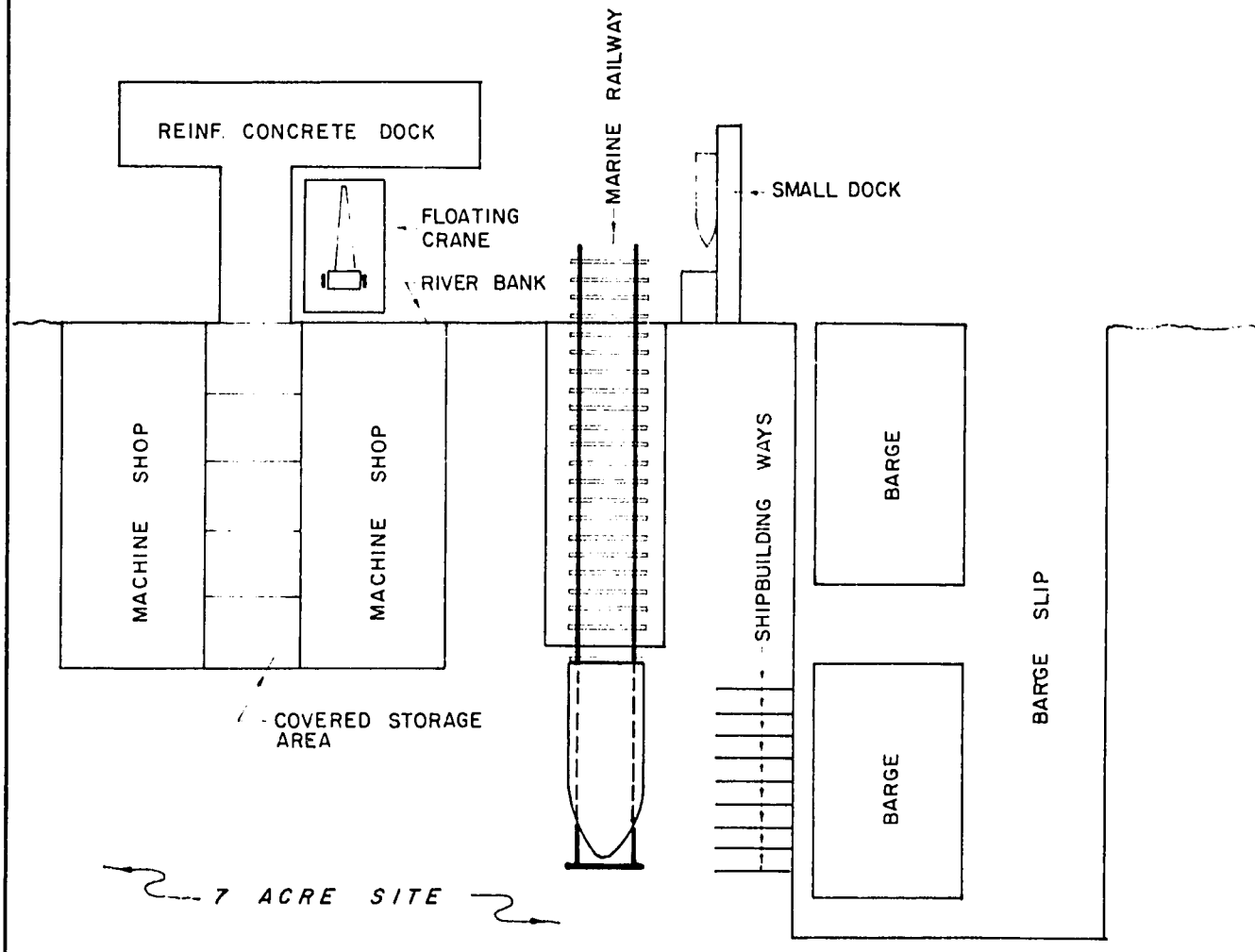
The Commercial Port of Saigon performs routine maintenance and repair on their own tugs and barges. They use the 60-ton derrick barge to lift barges onto the beach when work is to be done on them. They do not have a fabricating yard to build new barges and tugs. However, the Directorate of Navigation does maintain a rather extensive yard at Phu An where repairs can be affected to dredges as well as to their other floating equipment. This yard has also built several fuel barges, flat barges and tugs as well as other craft for servicing dredges. It would not seem advisable to expand this yard into the barge building business in competition with the free enterprisers doing the same type of work in the Saigon area. A sketch of the Directorate of Navigation facilities is shown in Exhibit 6. The entire area available to the Directorate of Navigation at Phu An is approximately seven acres.

Other than Saigon, the only barge building work of note is carried on at Da Nang. SOVITA recently completed the construction of three 150-ton steel hatch barges on temporary ways on the beach at Da Nang, as shown in Figure 39. By constructing barges in this manner, the very minimum of tools and equipment is required. They report that it takes about two months to complete one barge by fabricating it in this manner.

YARD LAYOUT

DEPT. OF NAVIGATION
PHU AN FACILITIES
SAIGON, VIETNAM

(NOT TO SCALE)



NOTE:
OFFICES AND OTHER FACILITIES
NOT SHOWN.

DANIEL, MANN JOHNSON, & MENDENHALL VIETNAM PORTS STUDY	
USOM/PWD	CONTRACT - AID 439-990
TUG AND BARGE CONSTR. PROGRAM	
DEPT. OF NAVIGATION GENERAL YARD FACILITIES	
BY D.A. WALSH	DATE JUNE, 1965

EXHIBIT # 6

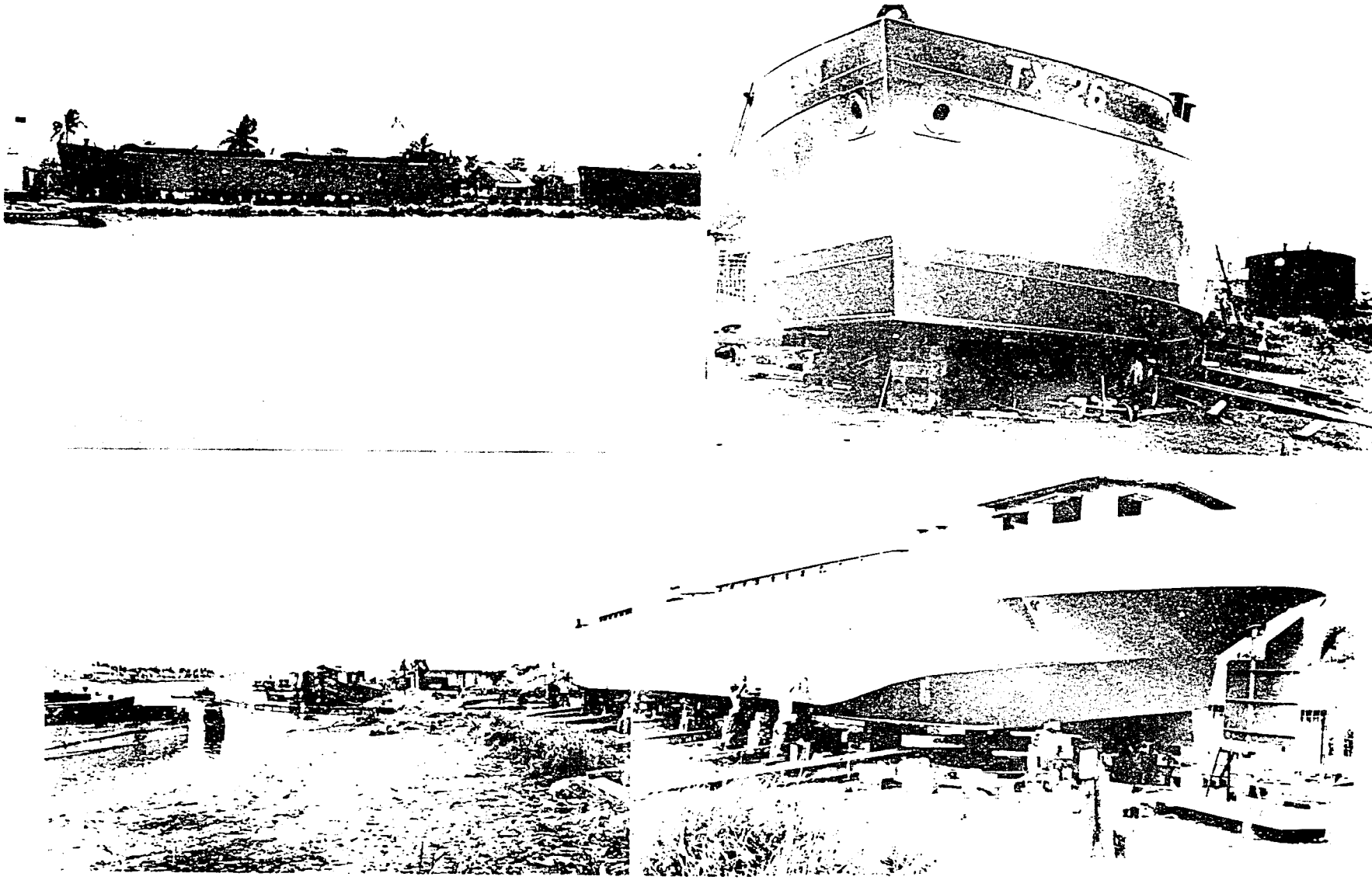


Figure 38. Two 500-ton capacity cement clinker barges under construction.
Shipyard of Pham Quang Khai

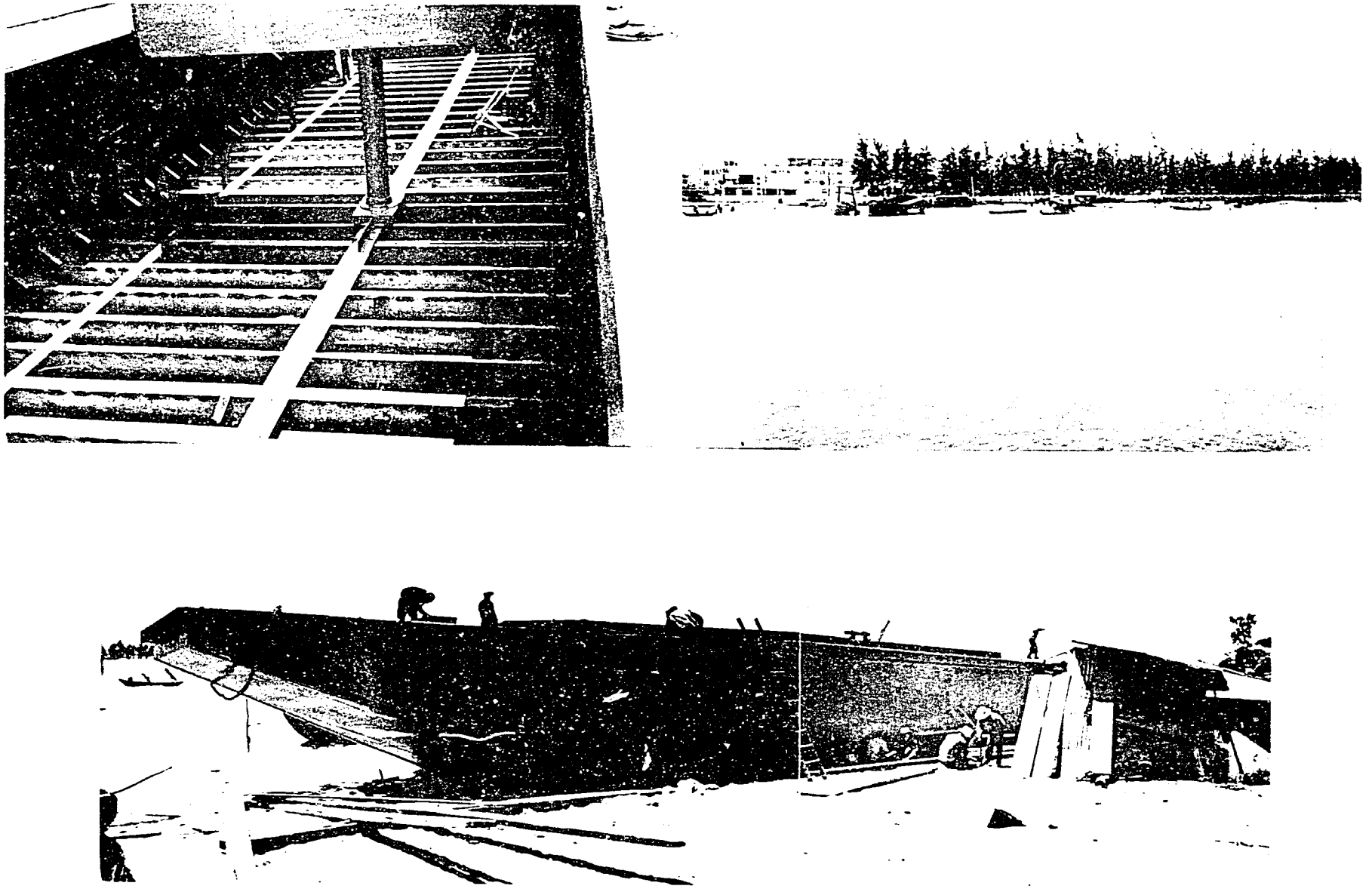


Figure 39. 200-ton capacity steel barge being fabricated by SOVITA - Da Nang

IV. REPLACING THE JUNK FLEET

The junk fleet and the small launches have always been the chief means of transport for both cargo and passengers throughout the delta area. It was previously the primary means of hauling rice from the delta collection points into Saigon and other delta cities.

Reduction in Number of Junks in Use

Due to a variety of reasons, the number of junks in use in the delta has decreased considerably over the past few years. The Sovicotra Company, which is one of the two largest stevedoring companies in Saigon and operates a sizeable junk fleet, reports that at one time they had 99 junks but due to the sale of a few of the older ones and others deteriorating beyond economical repair this fleet has now been reduced to 37. They have built no new junks for the past seven years, and they do not plan to build any more new ones in the future. This seems to be a fairly typical reaction from the junk users.

Economics of Building Junks versus Barges

The economics of building and using wooden junks versus other types of craft are not the same as was the case ten years ago. One of the principal reasons given is that a new wooden junk will cost approximately the same as a comparable steel barge. The maintenance costs for a wooden

junk, however, are at least 50% higher than for a steel barge, and this percentage increases as the junk gets older. Wooden junks have always had a leakage problem and are attacked by shipworms, whereas steel barges do not have leakage problems to the same extent. Also, insurance rates on steel barges are considerably less than for a wooden junk. All of these factors coupled with the shortage of CAO wood for making junks and the declining number of Vietnamese craftsmen who can build them will cause further decreases in the number of junks plying the waterways of the delta.

When one considers that the average life of a wooden junk is about 20 years and since few have been built in the last seven years, the conclusion is that if there is not a shortage of junks now there very likely will be in the near future.

Present Junk Operations

Junks and small launches are used on the delta waterways primarily for hauling milled rice and paddy, which makes up about 80% of the tonnage moved on the delta waterways. In addition, they also haul charcoal, wood, sand, crushed rock, cement, fertilizer, and other general cargo including a large amount of building materials. All of these materials could undoubtedly be hauled just as well in a well designed steel dumb barge or motor driven steel barge.

In order to arrive at a determination of new barge needs, an evaluation of the delta junk and barge fleet and of the volume of cargo they carry must be made. Reliable statistics on the number of junks now in service as well as cargo movements in the delta is difficult, if not impossible, to obtain.

Data from the National Statistical Institute for 1964 on the registration of junks was as follows:

Wooden Junks over 16 Tons	Number
16 to 50 tons	3,602
51 to 150 tons	505
151 to 250 tons	500
Over 250 tons	82
Total Junks Over 16 Tons	4,689

Total estimated carrying capacity for junks = 250,000 tons

The Ministry of Public Works and Communication has estimated that for 1965 the following cargo tonnages will be moved by barge and junk on the inland waterways to and from Saigon:

	Item	Tonnage
A.	Rice and paddy	1,400,000
B.	Clinker for Ha Tien Cement Co.	240,000
C.	Charcoal from Nam-Can	60,000
D.	Building Materials	100,000
	TOTAL	1,800,000

These tonnage figures would seem to be quite optimistic for the milled rice and paddy. It should be noted from Table I that the highest tonnage of paddy and milled rice over the past six years was only 749,160 tons. The average for the same period is only about 603,184 tons. The figures of the Ministry of Public Works and Communications would mean that the tonnage for the best year would have to be almost doubled. This appears to be highly unlikely. Based upon current production, it is probable that the tonnage of 1,400,000 will not be reached within the next five years.

Factors Affecting Cargo Tonnages

In addition, numerous other factors such as the following must be taken into consideration:

1. The population of the delta is increasing at the rate of about 1.5% per year, and there are now approximately 6,000,000 people in that area. With this increased delta population to feed, it is unlikely that tonnage figures comparable to 1959 will be achieved again for some time.

2. Practically all the rice now consumed in the delta is milled locally. More and more rice sent to Saigon from Can Tho and other inland ports is sent as milled rice. This contrasts sharply with pre-war practice when practically all paddy was sent into Saigon for milling and then the polished rice was sent back in to the delta area.

3. The trend is for increased feeding of rice to poultry and livestock, and then marketing the animals and fowls. Delta farmers contend that financially this practice is more rewarding than selling the rice directly.

TABLE I

DELTA CARGO MOVEMENTS
(Source: Customs Service Statistics)

	1959		1960		1961		1962		1963	
	Total	Rice & Paddy	Total	Rice & Paddy	Total	Rice & Paddy	Total	Rice & Paddy	Total	Rice & Paddy
Shipments from Saigon	235, 251T	2, 539T	214, 174T	1, 634T	203, 649T	2, 004T	209, 464T	3, 846T	266, 101T	2, 061T
Shipments to Saigon	858, 859T	749, 160	895, 968T	718, 334	728, 034T	590, 629T	633, 306	409, 241T	809, 392T	721, 251

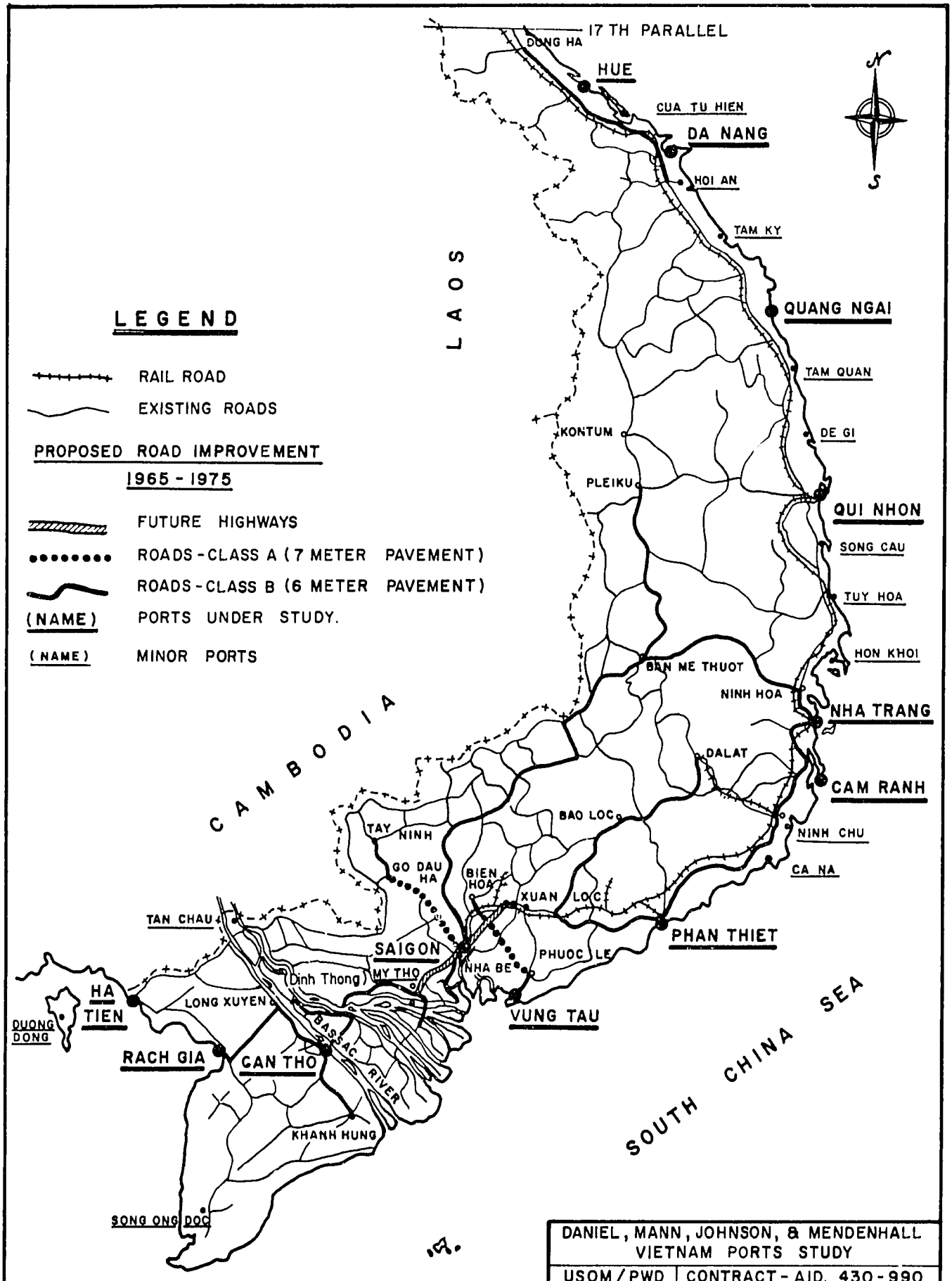
	1964		1965			
	Total	Rice & Paddy	Total	Rice & Paddy	Total	Rice & Paddy
Shipments from Saigon	268, 894T	1, 056T	Jan. 17, 486T	154T	March 16, 596T	414T
			February 12, 676T	0T	April 17, 935T	0T
Shipments to Saigon	524, 351T	430, 488	Jan. 47, 451T	38, 763T	March 69, 323T	53, 299T
			February 54, 731T	42, 166T	April 62, 901T	42, 836T

4. With the development of highways, particularly the networks now planned, (see Exhibit 7) more and more commodities will move by truck instead of by water. Up until recently, trucks were making considerable inroads into the rice hauling traffic from the delta areas to Saigon. This same situation is also occurring in the transport of livestock, fruit, and vegetables.

In arriving at the anticipated tonnages for delta barge traffic, the cement clinker from Ha Tien can be disregarded as the Cement Company can and does provide its own barges. This means that based upon past statistics a delta cargo movement of about 1,000,000 tons per year within the next five years could be anticipated. This, then,would represent the maximum tonnage for which a program of barge construction would have to be implemented. A re-study of this program would probably have to be made within two years, but the 1,000,000 tons per year figure seems realistic for determining present barge requirements.

Determination of Junk Replacement Requirements

From the figures previously given on the number of registered junks it would appear that they are adequate in number and carrying capacity. This is hardly the case, however, and spot checks have shown that these statistics do not reflect the actual situation. The registration rolls are apparently not changed even when junks are sunken or taken out of service. Also, it must be recognized that many junks are used as floating homes for families and often times the junk is seldom used as a cargo-carrying vessel.



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VIETNAM PORTS STUDY

USOM/PWD	CONTRACT - AID. 430-990

REPUBLIC OF VIETNAM

TRANSPORTATION MAP

BY: A. F. BENSCHEIDT	DATE: OCT. 1965.

EXHIBIT # 7

Even if one makes the reasonable assumption that the junk fleet is actually only about one-half of that reflected by the registration figures, it is still adequate. Considering, however, that few new junks have been built in the past seven years and that their average life is only about 20 years, it is quite obvious that a rapid decrease in the junk fleet can be anticipated over the next ten years.

The greater part of the cargo handled by the junk fleet is carried in the larger junks of 200-250 ton capacity. It is estimated that at the present time there are about 220 of these in service. Assuming that they will need replacing at the rate of 10% per year, or 22 units per year, the barge construction program should provide the equivalent cargo carrying capacity. Consequently, the first year's construction program could involve 22 new 250-ton steel barges. The second and succeeding years' program should not be established until the first year's production has been put into service and the need for additional barges has been determined, based upon junks actually being retired from service and a verification of delta cargo tonnages.

Types of Barges Required

If junks are to be replaced by barges over the coming years, the type of barge that replaces the junks must still have the same basic characteristics.

Junks were not only designed to haul cargo, but in most cases were a home for a family. This is not unique to the Far East, as it is a custom followed on barges plying the waterways in the low countries of Europe and, to some extent, in England and France. Details of a typical Vietnamese junk are shown in Exhibit 8.

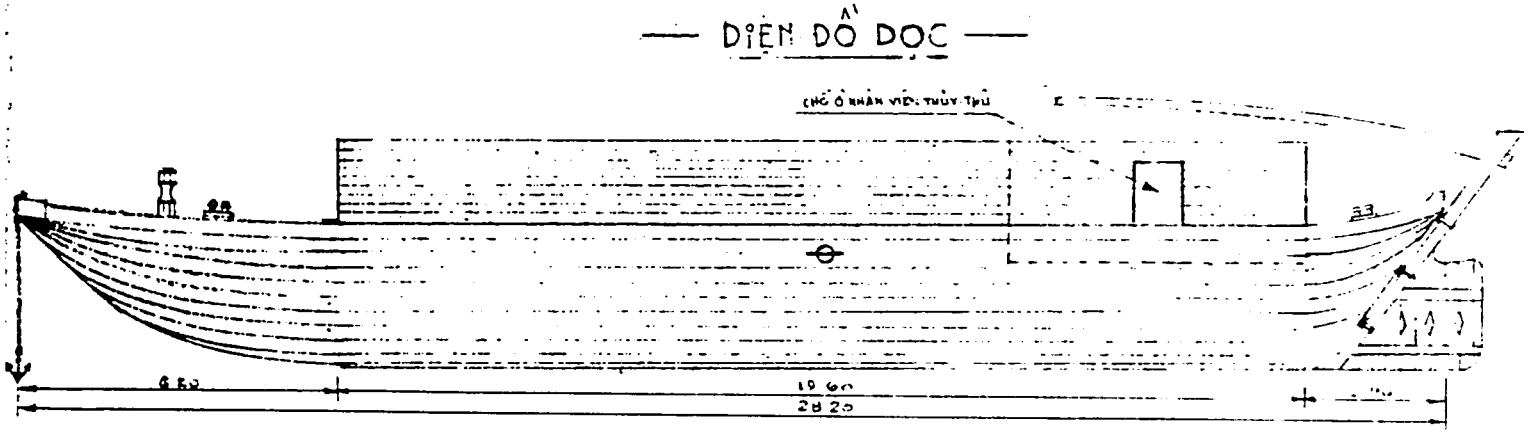
This practice will probably continue. Consequently, new barges should be designed with living accommodations plus the limitations as to draft and length placed on the junks by the depth of the water and sharp turns encountered in the canals. The height is also restricted by low bridges so a hatch type barge is also required in order to reduce the height. In general, barges should not have a draft of more than six feet, beam of more than 22 feet, and length not greater than 120 feet. It should be equipped with suitable hatch covers and have a rudder and ground tackle.

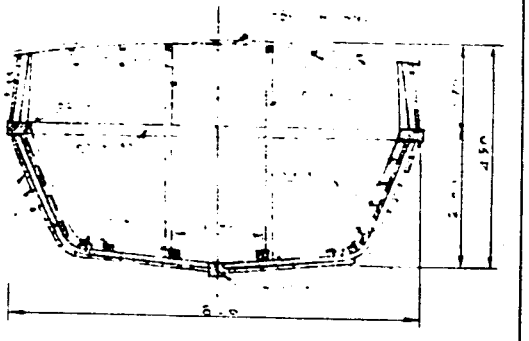
The holds will have to be equipped with wooden battens to keep the rice from contacting the metal or skin of the barge. This will also allow air to circulate and help to keep the rice from mildewing.

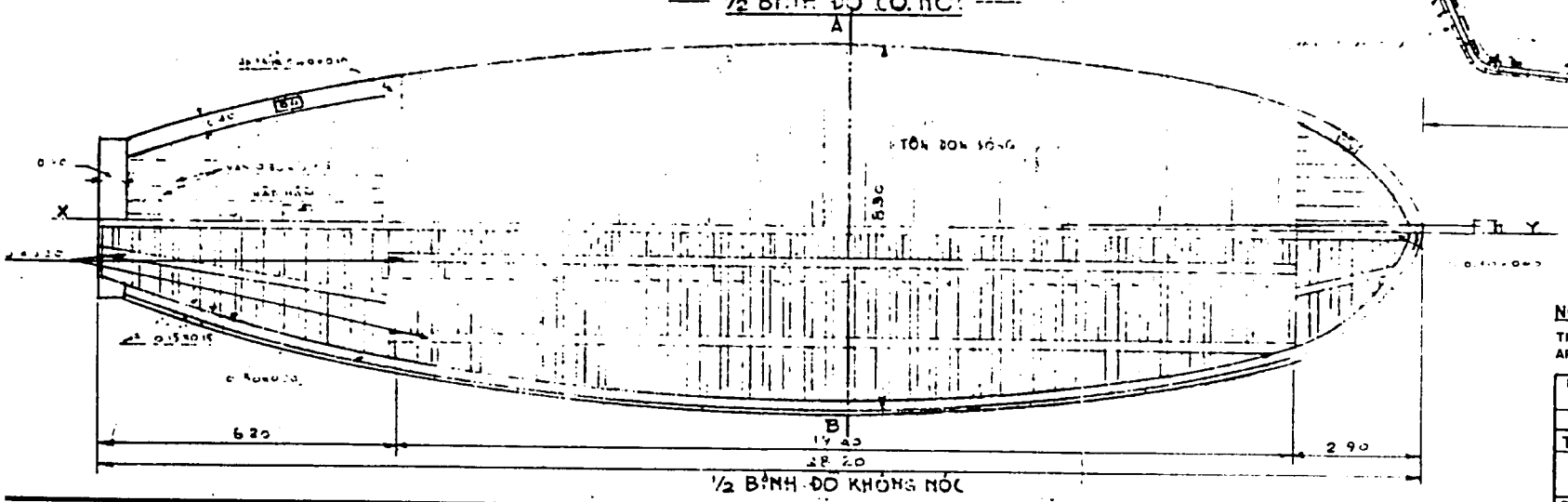
Each hold should have adequate ventilation. Two 12-inch swivel-type cowl ventilators forward and two 12-inch turbine-type aft should be adequate.

The hull for the new barges, with minor modifications to the super structure and interior of the holds, could be the same as those presently being built for the cement clinker haul from Ha Tien to Saigon.

TYPICAL VIETNAMESE JUNK







NOTE

THIS TYPE OF JUNK IS RATED AT APPROXIMATELY 250 TON CAPACITY

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USOM/PWD	CONTRACT AID. 430-990
TUG AND BARGE CONSTR. PROGRAM	
TYPICAL VIETNAMESE JUNK CONSTRUCTION DETAILS	
BY D. A WALSH	DATE JUNE, 1965

EXHIBIT # 8

This hull is suitable for the installation of engines and it would make a good power barge. Engines can be left out, however, and they can be used as dumb barges.

The above applies to the cargo haul in the inland waterways, but as junks are often used for lighering, so must the barges that replace the junks. Although barges of the type described can be used as lighters, they are not as suitable for the purpose as shorter and wider flat barges.

Lighter Design Features

For lightering service a barge of anywhere from 70 to not over 100 feet with a beam equal to approximately 1/3 its length is more suitable. These can be either flat barges or hatch barges as long as they are adequate to handle special cargo such as wide loads, heavy lifts, machinery, trucks, and so on.

Special Design Requirements

The type of 250-ton barge selected for design should be built for later mounting of engines and generator sets. No specific type of generator was selected, but it was felt that the Onan Generator sets, Series MDJC 12 KW, would be adequate for lighting, battery charging, bilge pumps, and fire pumps. Although this particular type unit would be more than adequate for the basic power needs, it has been found that the tendency

is to keep adding more equipment such as fans, lights, hot plates, and so on, until a smaller unit would be completely overloaded.

It was suggested that the bilge pump be belt driven through a clutch off the power take-off. By this method, the pump could be operated as long as the engine would run even though the generator itself went dead.

Until the motors and generators were installed manually operated bilge pumps, kerosene burning running lights, and cabin lights could be utilized. There are running lights available on the market that can be operated either by electricity or kerosene and cost but little more. Also, the manually operated bilge pumps are not expensive and would be good emergency equipment even though power operated pumps were installed later. Adequate fire protection can be had by providing each barge with several portable fire extinguishers. The dry chemical type would be good for almost any type of fire aboard a dumb barge.

Summary

In summary, the 22 new 250-ton barges should have the following design features:

1. There must be adequate provisions for quarters for the crew and their families. (See Figure 40)
2. They must have rudders to assist in steering on the narrow winding canals. Twin rudders are preferrable.

3. They must be equipped with ground tackle, such as anchors, windlass, davits, and other items.

4. The cargo must be protected from the weather with good tight hatch covers.

5. Tows are often made over long distances so a shaped hull form is required for ease of towing.

6. Limitations as to length, width, and draft due to shallow canals and the narrow sharp turns in the various waterways must be given consideration.

7. Some, if not all, should be equipped with motors for moving under their own power and for towing other barges and water craft.

8. Due to present maintenance practices and lack of spare parts, it is probably advisable to make provision for twin screws and dual engines so that in the event of breakdown of one engine the barge can still travel on the other engine even though at reduced speed.

The need for these barges, however, does not appear, at this time, to be sufficiently critical to justify a crash program, but rather one that is well planned and executed and which is capable of being scaled upward or downward to meet possible future conditions not anticipated or apparent at the present time. A sketch of the type barge recommended is attached hereto as Exhibit 9. A Bill of Material for this type of barge is shown in Table II.

Based upon such cost information as was available, the cost of these new barges (see Exhibit 9) would be as follows:

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95 Hong Thap Tu, Saigon, Vietnam

BILL OF MATERIAL

NOTE: All quantities include approximately 10% over-run for cutting and waste.

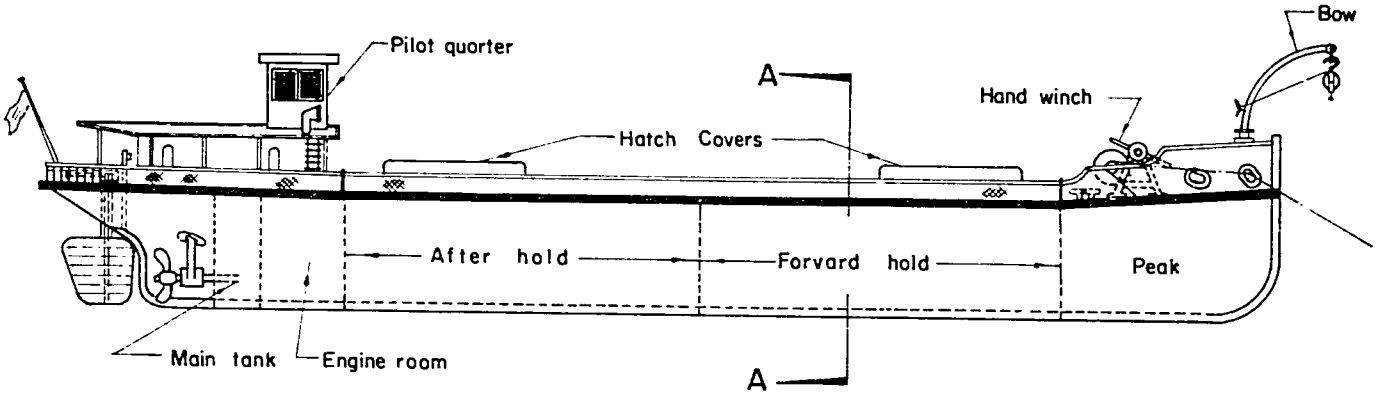
TABLE II

FOR ONE
250-TON CAPACITY BARGE

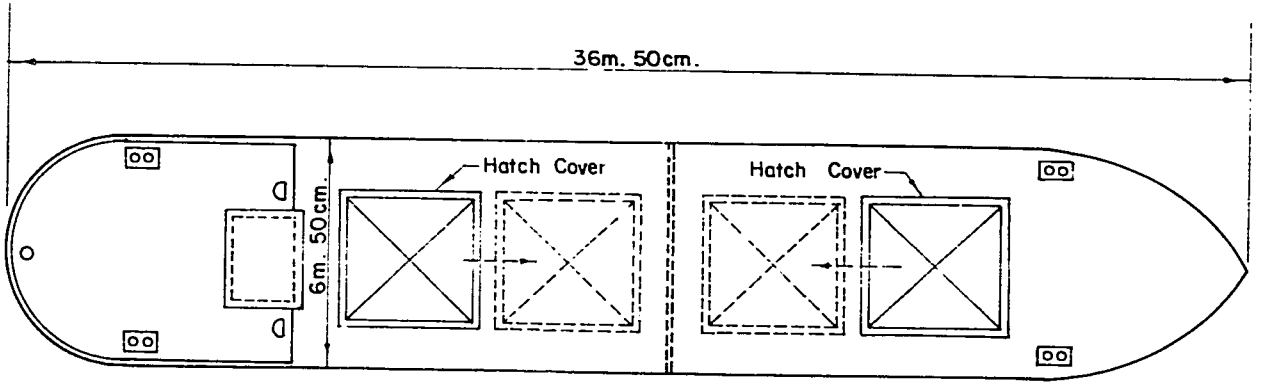
Prepared by: D. A. Walsh
Project Mgr.

Date: May 27, 1965

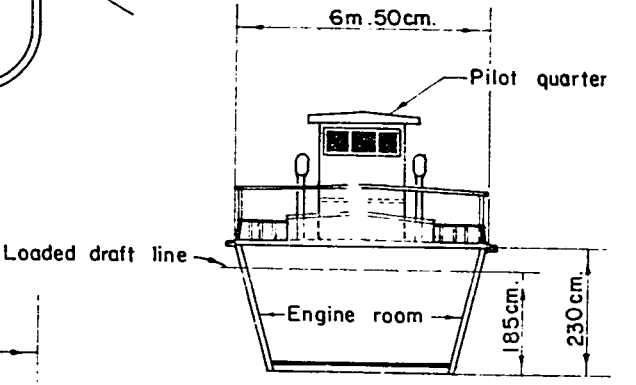
ITEM	LOCATION	STRUCT. SHAPE	THICKNESS	UNIT WT.	REQ'D AREA OR LENGTH	SHIPPING INSTRUCTIONS	TOTAL WEIGHT
	FRAMING:						
1.	4 x 4 x 3/8	Angle	3/8"	9.8#/L.F.	60 L.F.	2 - 30' Lengths	588 lbs
2.	3-1/2 x 2-1/2 x 5/16	Angle	5/16"	6.1#/L.F.	4,800 L.F.	120-40' Lengths	29,280 lbs
3.	3 x 3 x 1/4	Angle	1/4"	4.9#/L.F.	800 L.F.	20-40' Lengths	3,920 lbs
4.	4 x 3 x 3/8	Angle	3/8"	8.5#/L.F.	920 L.F.	23-40' Lengths	7,820 lbs
5.	7"	Channel	5/16"	12.25#/L.F.	20 L.F.	1 - 20' Length	245 lbs
6.	5"	Channel	5/16"	9.0#/L.F.	1,520 L.F.	38-40' Lengths	13,680 lbs
7.	Plate	Plate	3/8"	15.3#/L.F.	352 '	11-4'-8' Sheets	5,385 lbs
	HULL:						
8.	Deck	Plate	1/4"	10.2#/ '	416 '	13-4'x8' Sheets	4,243 lbs
9.	Bot. & Sides	Plate	5/16"	12.8#/ '	11,616 '	363-4'x8' Sheets	148,684 lbs
10.	W.T. Bulkheads	Plate	3/8"	15.3#/ '	1,664 '	52-4'x8' Sheets	25,459 lbs
11.	Headers	Plate	7/16"	17.9#/ '	2,720 '	85-4'x8' Sheets	48,688 lbs
12.	4"	Channel	5/16"	13.8#/ '	480 L.F.	12-40' Lengths	6,624 lbs
						TOTAL =	294,616 lbs
						TOTAL TONNAGE =	147.38
	WELDING RODS						
13.	1/8" Dia.	--	--	--	--	--	1,333 lbs
14.	5/32" Dia.	--	--	--	--	--	2,666 lbs
15.	3/16" Dia.	--	--	--	--	--	2,000 lbs



ELEVATION



PLAN



CROSS SECTION A-A

NOT TO SCALE

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USOM/PWD	CONTRACT - AID. 430-990
TUG AND BARGE CONSTR. PROGRAM	
TYPICAL 250 TON BARGE	
BY: D. A. WALSH	DATE JUNE, 1965

EXHIBIT # 9

EXHIBIT # 9

For one 250-ton barge with after-deck house and engine mounts –

1.	Uncut plates and structural shapes, f.o.b. U.S. Plant @ $.12/lb., avg. 148 tons @ $240/ton	$ 35,520
2.	Packaging and binding and transportation from Plant to Saigon @ $45/ton - 148 tons	6,660
3.	Welding Rods, misc. fittings, bitts and chocks	2,500
4.	Fabrication in Saigon and contingencies	35,000
5.	Painting and fenders	1,000
	Subtotal	$ 80,680
	For 22 Barges . .	$ 1,774,960

This estimate is considered to be realistic and could serve as the basis for budgeting this phase of the recommended program.

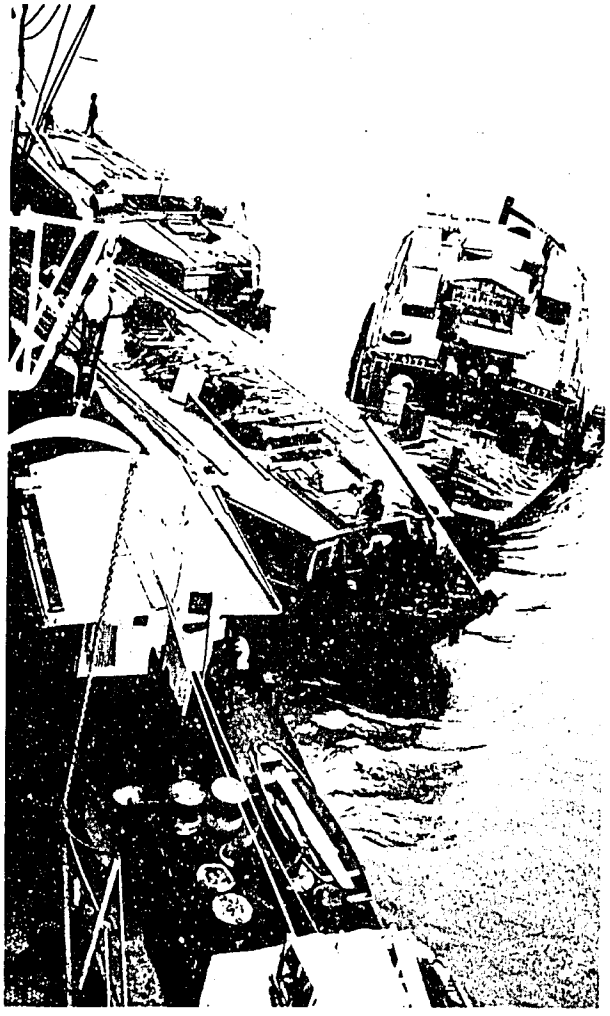


Figure 40. Junks and launches in operation alongside freighter on Saigon River.
(NOTE: Family living aboard junk in foreground.)

V. BARGE REPAIR PROGRAM

As an interim measure to provide more barges for the Commercial Port of Saigon in the shortest possible time, an extensive program to rehabilitate some of the present 32 deadlined barges which are now carried on their inventory (See Table III) was considered.

Present Repairs Needed

A brief field inspection of these barges indicated that 10 or 12 were beyond repair and could not be salvaged. There were approximately 20 barges, however, that could possibly be repaired and put back into service. The hull plating in need of replacing is mostly above the water line and the bottoms are still good. Figure 41 shows the general condition of these barges prior to repairing. There is also some deterioration, pitting and corrosion of the frames, but there are very few of the structural framing members that would need to be replaced.

Repair Schedule

The Chief of Material and Equipment for the Commercial Port of Saigon, Mr. Tran-Quoc-Ky, stated that his crews were presently repairing these barges at the rate of about one per month. Figures 42 through 47 give a general idea of the repair yard facilities. However, this schedule does not make for an increase in the overall number of barges available as they

TABLE III

COMMERCIAL PORT OF SAIGON

BARGE INVENTORY, CLASSIFICATION, AND USAGE

(EQUIPMENT REPAIR OFFICE RECORDS - JUNE 1965)

Barge Classification	Type & Origin	Tonnage Capacity (Metric)	Restricted Usage	Sunken or Lost	Dead-lined	Rented	Total
A	1930 Type	50 T	--	--	3	--	3
B	1930 Type	100 T	2	--	10	10	22
C	1930 Type	150 T	--	5	7	25	37
CA	Canadian Origin	150 T	--	10	4	22	36
CAT	Canadian, ex N. Viet Nam	150 T	--	--	--	1	1
CJ	Japanese Origin	150 T	2	--	--	1	3
D	1930 Type	200 T	--	2	1	2	5
DA	Ex-French	200 T	--	2	7	8	17
DA	Ex-French	300 T	--	--	--	1	1
HFB 1-2	Tanker	400 T	--	--	--	2	2
BC 3167-3168	Portoon Deck	500 T	--	--	--	2	2
	TOTALS		4	19	32	74 (21,450 T)	129 (39,650 T)

NOTE: All barges of the rental category are not necessarily seaworthy and should be used for inland transportation only.

go out of service for repairs about as rapidly as others can be repaired and put back into use. The principal problem seems to be the shortage of steel plate as it was indicated that if materials were available about three barges could be repaired per month with the present work force and equipment. This of course would mean if material is available, that instead of taking almost two years to repair, the presently sunken and damaged barges could be repaired in about six months.

Materials, Labor, and Cost of Repairs

It was estimated that on an average it requires about eleven tons of steel plate and structural shapes to repair each barge. Considering the labor and other items, the approximate cost of repairing one barge is as follows

1.	Pumping, re-floating, and drydocking	$ 2,000
2.	Steel plate - 11 tons @ $285/ton, delivered	3,135
3.	Labor	3,000
4.	Paint, welding rods, and miscellaneous	750
	Total	$ 8,885

Assuming this average per barge, then
20 barges = $177,700

From the information available with regard to the type and tonnage of barges now sunken or deadlined, a cost comparison of repairing versus new construction can be made as follows:

Deadlined Barges Type	No.	Tonnage (each)	Total Tonnage
A	3	50	150
B	10	100	1,000
C	7	150	1,050
CA	4	150	600
D	1	200	200
DA	7	200	1,400
Totals	32		4,400 ton cap.

The repair cost per ton capacity for 20 of these barges versus new 150-ton barges would be as follows:

Tonnage Capacity = 20/32 x 4400 = 2,750 tons capacity

Cost/ton capacity = $177,700/2,750 = $64.62/per ton capacity

New 150-ton barge @ $25,000 each = $25,000/150 = $166.67 per ton capacity

NOTE: The $25,000 cost of a new 150-ton barge is believed to be in line with current fabrication costs in Viet-Nam.

It should also be noted from Table IV that all barges that are in useable condition are rented out, and there can be little doubt that the repaired barges will quickly be put into service. Table V shows the basic barge rental rates now received by the Commercial Port of Saigon.

TABLE IV

DISPOSITION OF COMMERCIAL PORT OF SAIGON BARGES
(By Barge marking & classification as recorded for June, 1965)

	Barge Users Name or Location	Barges On Rental	
1.	Truong-Van-Cay	C-20	1
2.	Sovicotra	DA-6, DA-7, DA-3, DA-8	4
3.	Nguyen-Van-Hanh	HFB-1, DA-5, DA-16	3
4.	RMK	BC-3167, CA-17, DA-13, DA-14, DA-17	5
5.	ETS EIFFEL	B-25, C-7, C-26, C-31, C-60, BC-3168, CA-3, CA-38, HFB-2	9
6.	Ung Kim Thu Nguyet	C-47, C-24, C-2, C-30, D-5	5
7.	VN Sugar Refinery	B-4, B-30	2
8.	Vo-Thi-Khoa	C-21	1
9.	Ha Tien Cement Co.	CA-18, CA-42, CA-47, CA-65, CA-72, C-4, C-17, C-34, C-50, C-22, C-56, C-1, C-35	13
10.	Pham Quang Khai	C-53, C-55, C-33, C-58, CA-10, CA-22, CA-80, CA-20, CA-4, B-7, B-8, B-9, B-21, B-29, B-13, C-45, C-57, C-54, CA-43, CA-24, CA-53, CA-56, CA-64, CA-77, CA-15, CA-44, CA-50, CAT-1, CJ-3, D-12	31
		Subtotal =	74
		Restricted Usage Barges	
11.	Saigon Port, Constr. Office	B-10	1
12.	Saigon Port, OPS Office	CJ-1, CJ-2	2
13.	Le-Hong-Lien	B-16	1
		Subtotal =	4

(continued)

TABLE IV (Cont'd)

DISPOSITION OF COMMERCIAL PORT OF SAIGON BARGES
(By Barge marking & classification as recorded for June, 1965)

Barge Users Name or Location		Sunken or Lost Barges	
14.	Truong-Van-Cay	C-8, C-36 (sunk at Cat Lai)	2
15.	RMK	DA-15 (sunk at Da Nang, 9/15/64)	1
16.	Pham Quang Khai	C-49, C-30 (sunk at Vam Co 5/15/65)	2
17.	VN Sugar Refinery	CA-35, CA-41 (taken by VC 2/2/62 at Vam Co Dong)	2
18.	J. D. P. V.	DA-4, CA-13 (sunk at Bien Hoa Hwy Bridge)	2
19.	Pham Anh Tuyet	C-15, C-19, D-9, D-3, CA-39, CA-52, CA-63, CA-75, CA-76, CA-78 (reported sunken in collision)	10
		Subtotal =	19
		Deadlined Barges	
20.	Ton-That-Thuyet Mooring	A-4, A-5, B-3, B-11, B-12, B-15, B-17, B-18, B-27, B-28, B-1, B-9, C-28, C-40, C-46, C-43, CA-6, CA-8, DA-10, DA-1, DA-9, DA-12, DA-2 DA-18	24
21.	Repair Mooring	A-9, CA-40, CA-70, DA-10, DA-11	5
22.	Lai Thieu Mooring	C-11, C-13, C-29	3
		Subtotal =	32
		GRAND TOTAL =	129

COMMERCIAL PORT OF SAIGON

BARGE RENTAL RATES - VN$*

(for various barge types for from one to thirty days - June 1965)

Source: Equipment Repair Office - Flotilla Section

RENTAL		BARGE TYPE A (50 T)		BARGE TYPE B (100 T)		BARGE TYPES C - CA - CAT - CJ (150 T)		LARGE TYPES D-DA (200 T)	
Monthly Basis (tenths of a month)	Daily Basis (one-thirtieth of a month)	Within Saigon Port	Outside Saigon Port	Within Saigon Port	Outside Saigon Port	Within Saigon Port	Outside Saigon Port	Within Saigon Port	Outside Saigon Port
	1	86	103	172	206	258	310	344	413
	2	172	206	344	413	517	620	689	827
1	3	258	310	517	620	775	930	1,034	1,240
	4	344	413	689	827	1,034	1,240	1,378	1,654
	5	430	517	861	1,034	1,292	1,551	1,723	2,068
2	6	517	620	1,034	1,240	1,551	1,861	2,068	2,481
	7	603	723	1,206	1,447	1,809	2,171	2,412	2,895
	8	689	827	1,378	1,654	2,068	2,481	2,757	3,308
3	9	775	930	1,551	1,861	2,326	2,791	3,102	3,722
	10	861	1,034	1,723	2,068	2,585	3,102	3,446	4,136
	11	947	1,137	1,895	2,274	2,843	3,412	3,791	4,549
4	12	1,034	1,240	2,068	2,481	3,102	3,722	4,136	4,963
	13	1,120	1,344	2,240	2,688	3,360	4,032	4,480	5,376
	14	1,206	1,447	2,412	2,895	3,619	4,342	4,825	5,790
5	15	1,292	1,551	2,585	3,102	3,877	4,653	5,170	6,204
	16	1,378	1,654	2,757	3,308	4,136	4,963	5,514	6,617
	17	1,464	1,757	2,929	3,515	4,394	5,273	5,859	7,031
6	18	1,551	1,861	3,102	3,722	4,653	5,583	6,204	7,444
	19	1,637	1,964	3,274	3,929	4,911	5,893	6,548	7,858
	20	1,723	2,068	3,446	4,136	5,170	6,204	6,893	8,272
7	21	1,809	2,171	3,619	4,342	5,428	6,514	7,238	8,685
	22	1,895	2,274	3,791	4,549	5,687	6,824	7,582	9,099
	23	1,981	2,378	3,963	4,756	5,945	7,134	7,927	9,512
8	24	2,068	2,481	4,136	4,963	6,204	7,444	8,272	9,926
	25	2,154	2,585	4,308	5,170	6,462	7,755	8,616	10,340
	26	2,240	2,688	4,480	5,376	6,721	8,065	8,961	10,753
9	27	2,326	2,791	4,653	5,583	6,979	8,375	9,306	11,167
	28	2,412	2,895	4,825	5,790	7,238	8,685	9,650	11,580
	29	2,498	2,998	4,997	5,997	7,496	8,995	9,995	11,904
10	30	2,585	3,102	5,170	6,204	7,755	9,306	10,340	12,408

* All rates are rounded off to nearest Piastre. Official Exchange Rate, June 1965 @ 72.77VNS per U.S. $.

Benefit-Cost Ratio

From the above one can arrive at a benefit-cost ratio of repairing the presently sunken barges versus fabricating new ones of comparable size as follows:

$$\frac{166.67}{64.62} = 2.58$$

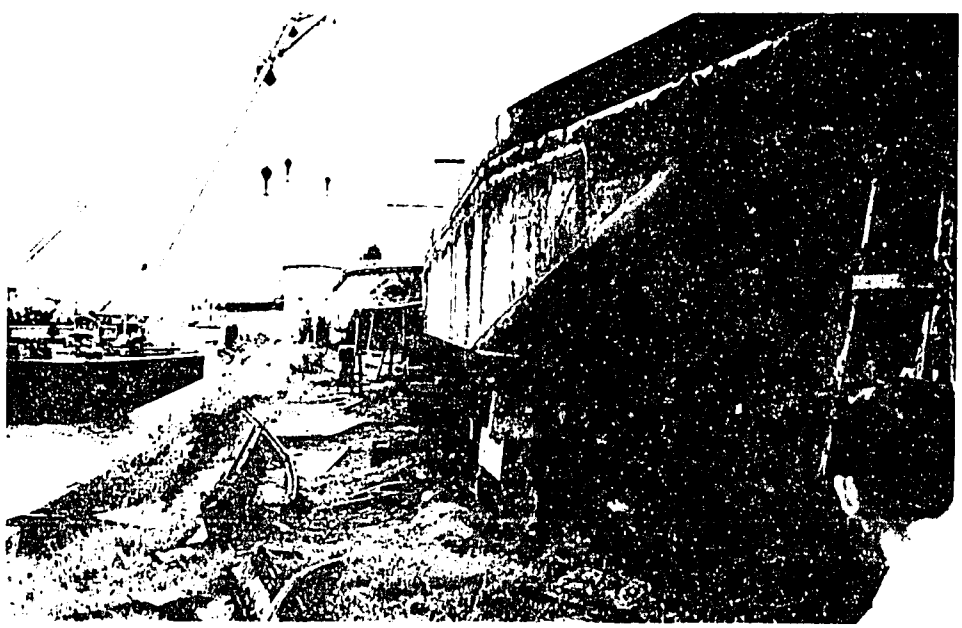


Figure 41. Commercial Port of Saigon. Barge repair work in progress.

It is obvious, however, that this figure should not be taken on its face value as the useful life of the two barges must also be considered, but as an interim emergency measure and considering the time factor for repairs versus new construction, it would appear that an extensive repair program does have some merit.

Figure 42. Commercial Port of Saigon - Maintenance Yard.

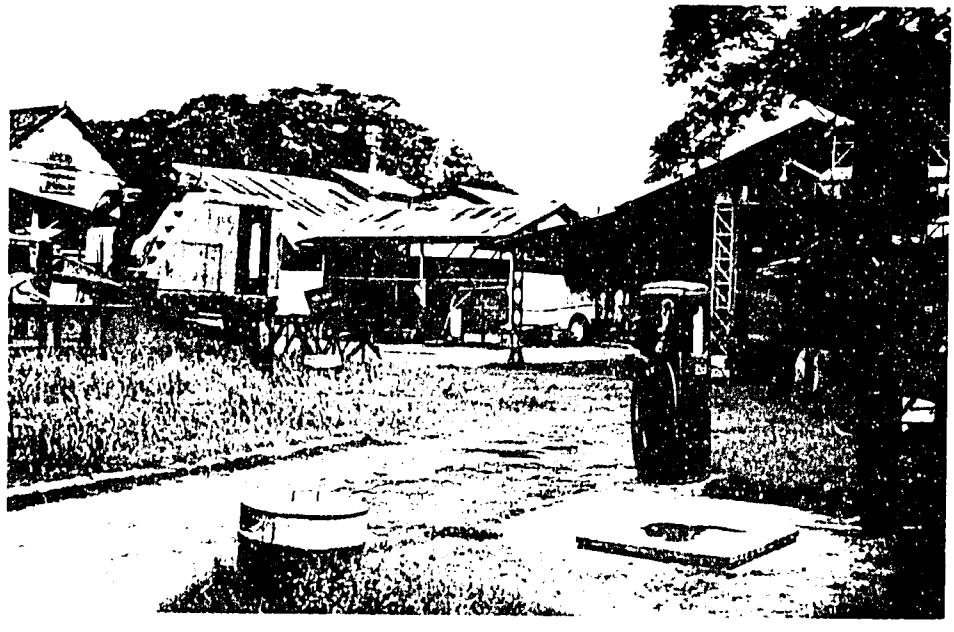


Figure 43. Commercial Port of Saigon - Maintenance Yard.

Figure 44. Commercial Port of Saigon - Repair & Maintenance Yards. Yard Junk

Figure 45. Commercial Port of Saigon - Steel Plate Storage Shed. Saigon

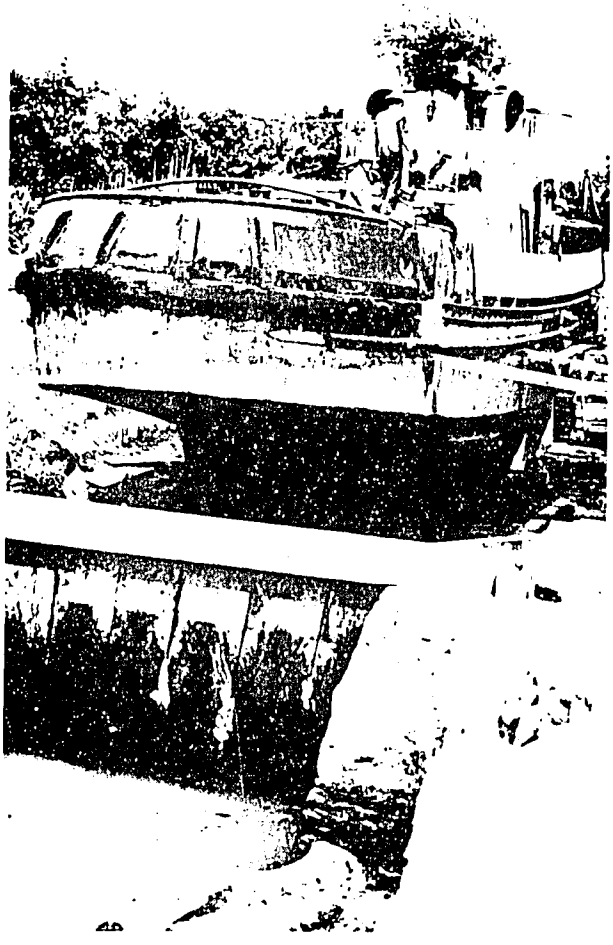


Figure 46. Small tug in dry dock at Cong Hoa - Saigon.

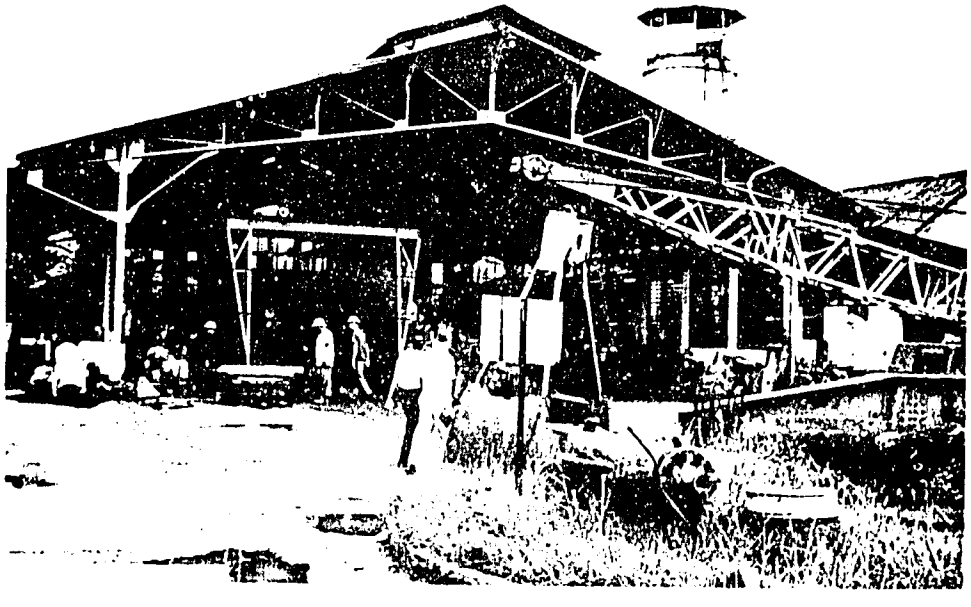


Figure 47. Maintenance Shop - Commercial Port of Saigon.

VI. TUG REQUIREMENTS

The need for additional tugs in Viet-Nam does not appear to be as critical as the need for barges and lighters. The basic problem with most of the present tugs is that many of them are old and maintenance is costly and time consuming.

Da Nang Requirements

The most pressing demand for tugs appears to be in Da Nang, primarily due to the rapid increase in cargo tonnages now passing through the port there. From preliminary observations, it would appear that at least two more 400 H. P. tugs could be used in Da Nang at the present time to help expedite off-shore unloading. For example, there was one recent case of a vessel laying off-shore in Tourane Bay for 28 days waiting to discharge its 1200 tons of cargo destined for the Port of Da Nang. These two additional tugs, although needed at the present time, will be even more urgent if the large 550-ton lighters recommended elsewhere in this report are fabricated and assigned to the Port of Da Nang.

Saigon Requirements

If the barge repair program also outlined in this report is undertaken by the commercial Port of Saigon, an additional 400 H. P. tug should be assigned to the Port of Saigon to help handle the increased number of barges in operation there.

It is therefore recommended that for the first year of the tug and barge construction program, that at least three 400 H. P. tugs be built and put into operation in Viet Nam--a type equal or similar to that shown in Figure 10 is recommended. The basic design requirements for these tugs should be as follows:

a) Maximum draft not to exceed six feet

b) Engines; 2-GM, 6-71 diesels or equal (to develop not less than 400 H. P.)

c) Crews quarters

d) Length and beam - not critical

e) Auxiliary generators and engine room ventilators

f) Extra heavy hull plates to allow for rust and pitting due to a lack of painting and maintenance.

g) Twin screw and twin rudders.

Partial Tugboat Inventory

An attempt to make an inventory of the number of tugboats available in Viet Nam was made but it was not completed at the time of cancellation of this aspect of our contract. However, the following list probably represents a sizeable percentage of the present total:

a) Commercial Port of Saigon

3 - 80 HP tugs
2 - 150 HP tugs
2 - 250 HP tugs
2 - 270 HP tugs - Fire boats
2 - 400 HP tugs
1 - 600 HP tugs
1 - 1,200 HP tugs

b) Esso Oil Company

2 - 85 foot, 12 foot draft, twin 450 H. P. engines, pre-war design (no load speed 7 knots)

3 - 250 HP twin engine, twin screw, pusher type

c) Department of Navigation - Saigon Office

12 - 200 H. P. tugs
1 - 300 H. P. tug (Primarily for salvage work)

d) Can Tho

3 - 250 H. P. steam tugs (owner or operators unknown)
1 - 150 H. P. tug (SOVICOTRA)

e) Da Nang

1 - 250 H. P. steam tug (SOVITA)
1 - 150 H. P. diesel tug (SOVITA)
1 - 150 H. P. diesel tug (VITABO)

f) Nha Trang

1 - 600 H. P. diesel tug

g) Saigon - Misc. Owners

4 - 700 H. P. tugs (owners not identified)
1 - 2000 H. P. tug (owned by Japanese salvage firm and is frequently seen in the Saigon area)

It should be recognized that this listing is incomplete and possibly contains erroneous information. It should be utilized only as a guide in evaluating the present tugboat fleet in Viet Nam.

Canadian Research Program

During the course of our rather limited study and research relative to tug and barge operations, the following operational tests of three different types of barges and three different tugs with varying H. P. was recorded

over a one-year period by Yarrows, Ltd., Shipbuilders of Victoria, British Columbia, Canada, and is of special interest:

A. Using 800 H. P. Tugboat

Barge	Average Load	Average Speed
21	813 tons	5.58 knots
36	890 tons	6.36 knots
44	900 tons	7.09 knots

B. Using 600 H. P. Tugboat

Barge	Average Load	Average Speed
21	792 tons	4.96 knots
36	880 tons	6.32 knots
44	930 tons	6.83 knots

C. Using 400 H. P. Tugboat

Barge	Average Load	Average Speed
21	846 tons	4.67 knots
36	899 tons	5.48 knots
44	922 tons	6.62 knots

Information on the specific configuration of each of these barges was not available other than the fact that barge No. 21 was of wood construction and not of particularly good towing form. It had a square bilge and bluff bow and a well rounded bow and raked stern. Barge No. 44 was of steel

construction and built to a form recommended by the Canadian National Research Council as a result of tests they had carried out to determine the hull form offering the most economical construction and lower tow rope resistance in comparison to conventional forms. The full results of these tests are available in National Research Council Report Number MB-165.

The most interesting aspect of this study is in the comparison of the operational characteristics of barge No. 44. It is noted that with a 900-ton barge load, the 800 H. P. tug has a speed of less than 1/2 knot more than a 400 H. P. tug towing the same barge but with 922 tons of load. From this, it would seem that with properly designed barge hulls, the smaller tugs are quite efficient and the economics of operating an 800 H. P. versus a 400 H. P. for an additional 1/2 knot of speed would not appear to justify purchasing the large tug for this type of operation.

Tug Design Criteria

It is primarily for the above reason that tugs of greater than 400 H. P. are not primarily recommended for general barge work in Viet Nam. For heavy jumbo barges, berthing of ships and coastal tows, tugs of greater H. P. are required, but several large tugs are now available in Viet Nam. The present need appears to be primarily for river tows and for moving lighters to and from buoys and alongside freighters

Time did not permit the making of detailed estimates on the cost of these tugs; however, the following quotation was received from Kall Teck, Ltd.

of 31 Mortaban Road, Singapore 12, Malaysia, for small 400 H. P. tugs (See Exhibit 10) of the following dimensions:

Length - 54'-0"

Beam - 15'-3"

Draft - 6'-3"

Alternate 1

Buyer furnishes all steel plate, shapes, engines and accessories	$91,000

Alternate 2

Buyer furnishes steel plate and shapes only	$98,500

Alternate 3

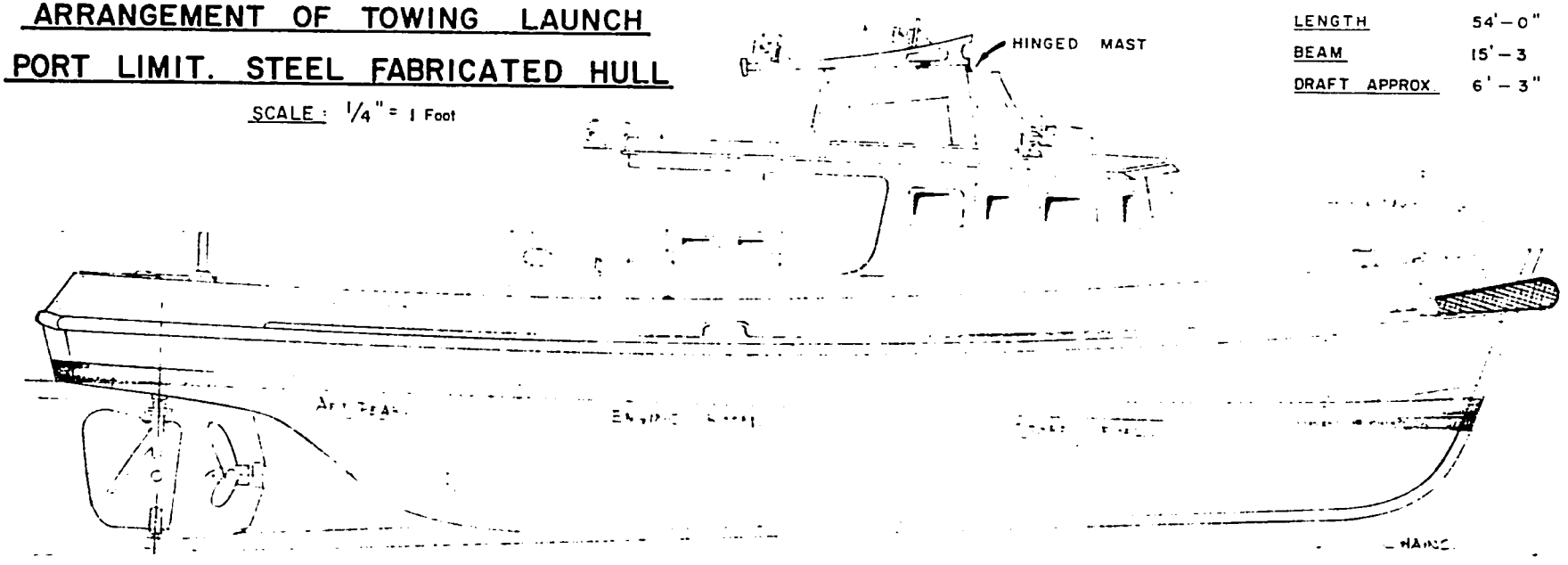
Builder furnishes all items	175,000
Towing cost from Singapore to Saigon estimated @	2,800
Assuming Alternate 3 @ 175,000/tug, plus towing to Saigon @ $2,800 =	177,800
Total for 3 tugs @ 177,800 each----------	$533,400

The possibility of fabricating these tugs in Saigon was considered, but it was believed that this additional work would unduly overload the existing shipbuilding facilities in Saigon and therefore it should probably be done elsewhere. It is believed that this cost is quite high and if better quotations can be obtained, the balance should be spent on spare parts and repairs to existing tugs.

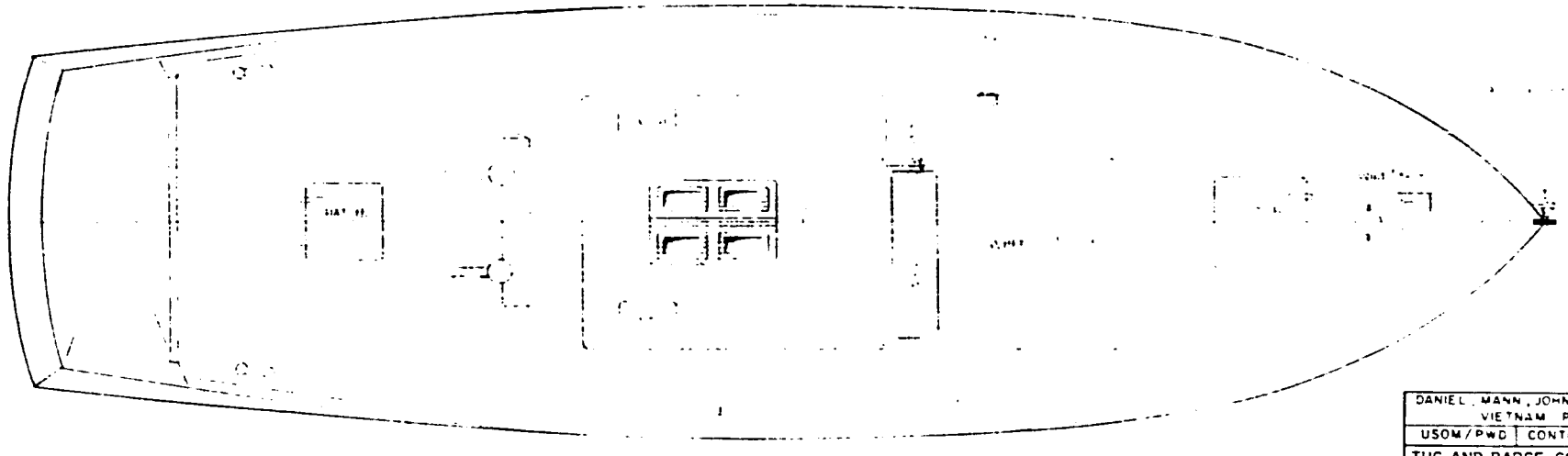
ARRANGEMENT OF TOWING LAUNCH
PORT LIMIT. STEEL FABRICATED HULL

SCALE : 1/4" = 1 Foot

LENGTH	54'-0"
BEAM	15'-3
DRAFT APPROX	6'-3"



PROFILE



DECK VIEW

DANIEL, MANN, JOHNSON, & MENDENHALL VIETNAM PORTS STUDY	
USOM/PWD	CONTRACT - AID 430-990
TUG AND BARGE CONSTR PROGRAM	
TYPICAL 400 H.P. TUG	
BY D A WALSH	DATE JUNE, 1965

EXHIBIT #10

VII. LIGHTER REQUIREMENTS

Basic Needs

If an extensive barge repair program is undertaken as outlined elsewhere in this report, the need for new lighters is not too critical, particularly when combined with more efficient cargo handling practices. There does seem to be a need, however, for four large lighters of about 550-ton capacity, three for Da Nang and one for Saigon.

Assuming that the repair of the 20 smaller barges can be made as planned, probably not more than one of the large lighters would have to be assigned to Saigon. In fact, it should be used in lieu of the two smaller barges now lashed together with a platform across them for transporting locomotives and other heavy lifts (see Figure 8). This would free these two smaller barges for other use.

Three of the new 550-ton lighters should definitely be sent to Da Nang to help expedite off-shore loading and unloading in Tourane Bay. A standard lighter of the type shown in Exhibit 11 would be quite adequate for these needs.

Material Requirements

A bill of material for this type of lighter is shown in Table VI. It should be recognized that this bill of material pertains to the specific type of barge for which the take-off was made and should not be used as a general figure for steel tonnage for any 550-ton lighter.

DANIEL, MANN, JOHNSON, & MENDENHALL
95 Hong Thap Tu, Saigon, Vietnam

BILL OF MATERIAL

NOTE: All quantities include approximately 10% over-run for cutting and waste.

TABLE VI

FOR ONE

550-TON CAPACITY BARGE

Prepared by: D. A. Walsh
Project Mgr.
May 27, 1965

ITEM	LOCATION	STRUCT. SHAPE	UNIT WT. (Lbs./S.F.)	REQ'D. AREA OR LENGTH	SHIPPING INSTRUCTIONS	TOTAL WEIGHT (Lbs.)
	HULL		#/□'	□'		
1.	Bot. & Sides	Flat Pl-1/4"	10.2	6976 '	218 sheets 4'x8'	71,300
2.	Deck	Flat Pl-5/16"	12.75	4000 '	125 sheets 4'x8'	51,000
3.	W. T. Bulkheads	Flat Pl-3/16"	7.65	1600 '	50 sheets 4'x8'	12,220
4.	Headers	Flat Pl-1/2"	20.4	192 '	6 sheets 4'x8'	3,920
5.	FRAMING		#/L.F.	L.F.		
5.	3x3x5/16	Angle - 5/16"	6.1	600	15-40' Lengths	3,660
6.	3 1/2x3 1/2x5/16	Angle - 5/16"	7.2	480	12-40' Lengths	3,460
7.	4x3x5/16	Angle - 5/16"	7.2	2400	60-40' Lengths	17,300
8.	4x3x1/4	Angle - 1/4"	5.8	880	22-40' Lengths	5,100
9.	5x3x5/16	Angle - 5/16"	8.2	1120	28-40' Lengths	9,200
10.	5x5x3/8	Angle - 3/8"	12.3	400	10-40' Lengths	4,920
11.	6x3 1/2x3/8	Angle - 3/8"	11.7	1000	25-40' Lengths	11,700
	MISC. PLATES		#/□'	□'		
12.	Webs & Bars	Flat Pl-1/4"	10.2	440 '	22-Plate 2'x10'	4,500
13.	Webs & Bars	Flat Pl-3/8"	15.3	135 '	9-Plate 1'-6"x10'	2,070
14.	Webs & Bars	Flat Pl-7/16"	17.85	30 '	2-Plate 1'-6"x10'	536
15.	Webs & Bars	Flat Pl-1/2"	20.4	210 '	7-Plate 3"x10'	4,300
16.	Webs & Bars	Flat Pl-3/4"	30.6	20 '	2-Plate 1'x10'	612
17.	Webs & Bars	Flat Pl-1 1/2"	61.2	18 '	4-Plate 1'-6"x3'	1,100
	BRACKETS & FLANGES		#/□'	L.F.		
18.	8" x 1/4"	Flat Pl - 1/4"	10.2	552	46-12' Lengths	3,760
19.	21" x 5/16"	Bent Pl	10.2	372	31-12' Lengths	8,300
20.	23" x 5/16"	Bent Pl	12.75	372	31-12' Lengths	9,100
21.	12" x 5/16"	Bent Pl	12.75	360	30-12' Lengths	4,610
					TOTAL	237,668
					TOTAL TONNAGE	118.83
	FENDER MOUNTS					Lbs.
22.	Lag Screws	3/8"ϕx3" LG	----	----	----	96
23.	Wood Screws	#16 x 4" F.H. Galvanized Steel				3,800
	WELDING RODS					
24.	1/8" Dia.	----	----	----	----	1,200
25.	5/32" Dia.	----	----	----	----	2,500
26.	3/16" Dia.	----	----	----	----	2,000

A rough estimate of steel tonnage required for fabrication versus carrying capacity for most types of barges and lighters can be estimated from the following formula:

Fabricated tonnage of steel $^{(1.27 \text{ power})}$ = carrying capacity in tons.

Partial Inventory

Time did not permit the taking of a complete inventory of all tugs and barges in use in Viet-Nam. However, the following information was obtained with regard to the principal sources and users of this equipment:

1. Da Nang

   a) S.O.V.I.T.A.

      12 barges - 170 tons capacity each

   b) V.I.T.A.B.O.

      11 barges - 150 tons capacity each

2. Saigon

   a) STIC

Barge Designation	Number	Tonnage	Total Tonnage
8605	2	150	300
6767	1	170	170
6765	1	200	200
8717	1	150	150
1517	1	140	140
F.D.	3	180	540
Totals ------	9		1,500

b) SOVICOTRA

Barge Designation	Number	Tonnage	Total Tonnage
Junks & Lighters	40	100	4000

NOTE: This listing does not include the barges previously identified as belonging to the commercial Port of Saigon and which are included in Section IV.

During the course of study of this program, some tentative price quotations were received from various fabricators. These are listed herein as merely a guide since such factors as: (1) who would design the barges; (2) who would furnish the engines, auxiliary equipment, paint and other related items which were not clearly defined in these price quotations.

1. SOVITA at Da Nang - 150-ton steel Hatch barge, including steel plate and shapes - VN$1,000,000 @ 72.77 VN$/US$ = $13,700

2. Hull repair costs in general at Saigon yards:

   a. Client furnishes steel — U. S. $0.12/kilo of steel used
   b. Shop furnishes steel — U. S. $0.35/kilo of steel used

3. Harbor Boat Building Company - Los Angeles, California

   a. Flat Deck Barge - 110' x 34' - 550 tons = U.S. $ 80,000
   b. Flat Deck Barge - 135' x 45' - 1500 tons = U.S. $ 110,000
   c. Flat Deck Barge - 210' x 55' - 3100 tons = U.S. $ 245,000

4. CARIC - Saigon (Purchaser furnishes steel)

   a. 200-ton flat barge — U.S. $20,000

   b. 300-ton flat barge — U.S. $30,000

c. 500-ton flat barge (heavy construction)	U.S. $55,000
d. 350-ton power barge with 200 H.P. engine	U.S. $50,000
e. 150-ton dumb barge, shaped hull	U.S. $15,000
f. 200-ton dumb barge, shaped hull	U.S. $21,000
g. 250-ton dumb barge, shaped hull	U.S. $24,000
h. 300-ton dumb barge, shaped hull	U.S. $28,000
i. 350-ton dumb barge, shaped hull	U.S. $31,000
j. 500-ton dumb barge, shaped hull	U.S. $62,000

5. KALL TECK, LTD. - Singapore

a. 400 H.P. tug (buyer furnishes steel and engines) 54'-0" x 15'-3" x 6'-3" over-all dimensions	U.S. $91,000

6. CHANIC - French Firm

a. Pusher type 400 H.P. tug (56' x 16' x 6' over-all dimensions - complete with 2 D-333 Caterpillar engines and quarters for crew. It is presumed in price that buyer furnishes steel.)	U.S. $54,300

NOTE: For small motorized craft of this type, a price of $1,500 per foot of length is generally considered normal. The CHANIC proposal would therefore be somewhat in line with generally competitive prices.

The prices of various barges and tugs cannot be categorized, however, by strictly tonnage capacity or H.P., as there are many design features that can change the amount of steel appreciably for one type of craft versus another even though they might have the same tonnage capacity.

Cost Estimate

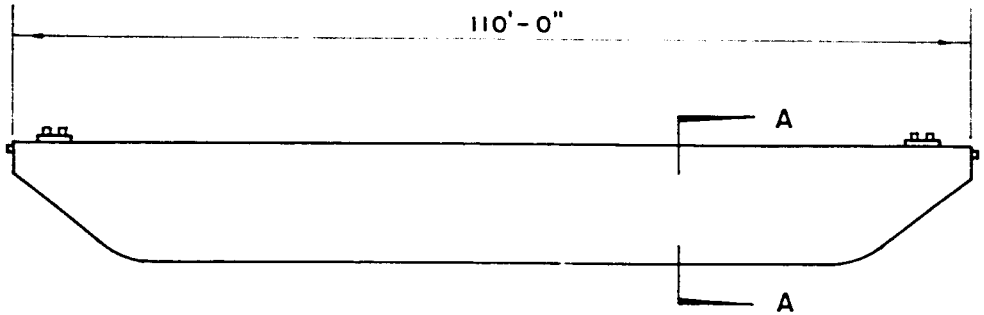
A reasonable cost estimate per 550 ton barge, based upon current steel prices and shipping charges would be as follows;

For one 550-ton flat barge:

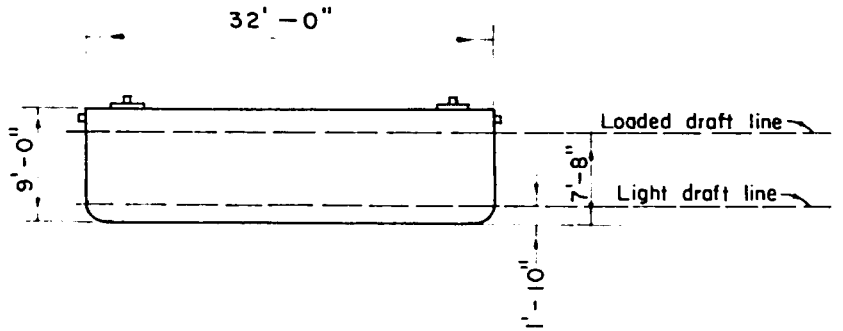
1.	Uncut plates and structural shapes, F.O.B. U.S. Plant @ $.12/Lb., avg. 118 tons @ $240/ton	$ 28,320
2.	Packaging and binding and transportation from plant to Saigon @ $45/ton--118 tons @ $45/ton	5,319
3.	Welding rods, misc. fittings, bitts and chocks	2,000
4.	Fabrication in Saigon and contingencies	55,000
5.	Painting and fenders	1,000
	Subtotal	$ 91,630
	For four barges	$ 366,520

This price is believed to be fairly realistic and in line with current costs in Vietnam.

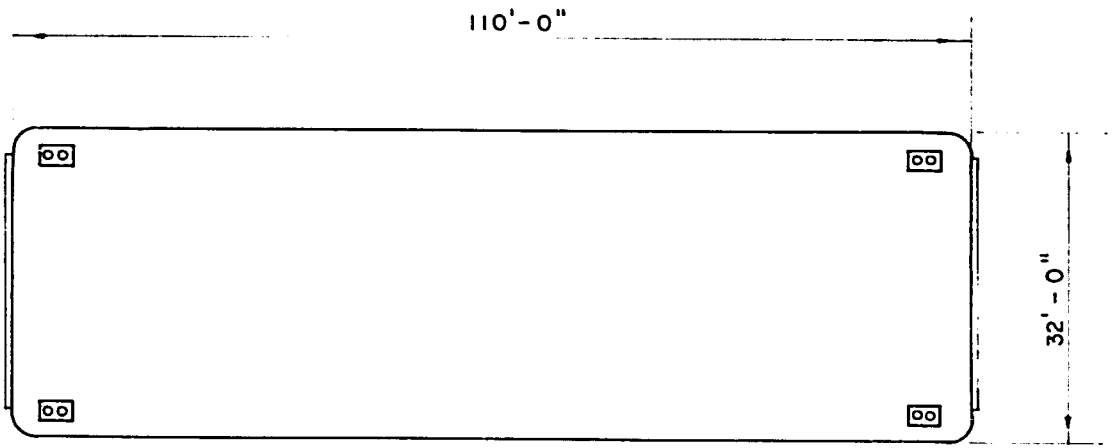
See Exhibit 11 for details of typical lighter.



ELEVATION



CROSS SECTION A-A



PLAN

NOT TO SCALE

DANIEL, MANN, JOHNSON, & MENDENHALL VIETNAM PORTS STUDY	
USOM/PWD	CONTRACT - AID. 430-990
TUG AND BARGE CONSTR. PROGRAM	
TYPICAL 550 TON CAPACITY BARGE	
BY: D. A. WALSH	DATE: JUNE, 1965

EXHIBIT # 11

EXHIBIT # 11

VIII. CONCLUSION

Based upon the studies and investigations undertaken from the beginning date of the DMJM contract on April 3, 1965 to June 18, 1965, the cancellation date of the tug and barge aspect of this contract, a rather extensive program of tug and barge construction was in the preliminary planning stage jointly between U.S.O.M., DMJM and GVN.

Prior Planning

The program outlined herein does not necessarily reflect the exact details of this preliminary planning, but there are several items included in these recommendations that were considered previously. For example, the type and tonnage capacity of the barges as well as the size and H.P. of the tugs was agreed to by all parties concerned. The barge repair program, however, was not considered in great detail at the time. Also, the number of tugs and barges recommended in this report differ somewhat from the preliminary plan. Regardless of these minor differences, there was common agreement that additional barges and tugs are needed in Viet-Nam to meet both the present and future cargo handling and canal transport requirements.

The Program

Based upon the needs as assessed in this brief study, the following program would appear to be realistic and necessary for the immediate present:

IX. COST SUMMARY

a) Repair of 20 barges - Port of Saigon	$177,700
b) Construction of 22 new 250-ton barges	1,774,960
c) Construction of 4 new 550-ton lighters	366,520
d) Construction of 3 new 400 H. P. tugs	533,400
Total Program Cost------	$2,852,580

Barge Repair Program

The barge repair program probably has the most urgency as it will provide considerable cargo carrying capacity in the shortest possible time. This is also a program that can be done largely with Vietnamese personnel and only a relatively small amount of foreign imported material.

Barges

With regard to the smaller barges, it is believed that new units should be built along the same lines as those now in use in Viet-Nam for the hauling of cement clinker. These barges have satisfactorily met existing navigational requirements with respect to draft, width and length, for use on the more shallow and congested canals of the delta area. It is recommended that all of these barges should be constructed with engine mounts and sealed shaft openings for the future addition of engines, if found desirable or necessary.

The initial construction phase recommended does not take into considera-

tion the purchase or installation of engines, but it was generally agreed that the General Motors 6-71 engine would probably be most adaptable to their needs when and if required. This marine engine is now in widespread use in South Viet-Nam and spare parts are readily available; however, other comparable types of engines could be used also. As most barges and rivercraft in general in South Viet-Nam have crews and their families living aboard, provisions should be made for a combined pilot house and crews quarters on the stern of the barges.

Lighters

Consideration of the 550-ton lighters was primarily for use at Da Nang to expedite off-shore loading and unloading from ships anchored in Tourane Bay. Although these are to be flat deck cargo barges, they could also very easily be converted into covered lighters and utilized as floating warehouses. The basic justification for their need, however, was to try to cut down ship waiting time at Da Nang for the loading and unloading of general cargo now offloaded into small junks and barges.

Tugs

Although recommendations as to the specific type of tugs to be built are somewhat flexible, a small 400 HP tug was thought to be adequate for present needs. A standard design of Kall Teck, Ltd. of Singapore is included in this report for reference.

It was the intent that two of these tugs would be assigned to Da Nang and

one left in the Port of Saigon. Due to the scarcity of mechanical and electrical items, it was also considered advisable that these tugs be fabricated either in the United States and shipped to Viet-Nam, or possibly fabricated in either Hong Kong or Singapore, depending upon USAID procurement regulations.

Special Considerations

During the early stages of the study, there was considerable discussion as to whether the barges and tugs should be built for pusher type operations, as this is generally accepted as the most efficient type of propulsion technique. This method, of course, requires special framing in the bow and stern of the barges, as well as the addition of special bumpers to both the tugs and the barges. Also, it was realized that the Vietnamese had very little experience with this type of towing practice, except for the oil companies, and operating problems could occur in changing to pusher type operations. However, the important thing is to get the tugs and barges built and delivered and such modifications as these could be added at a later date if found desirable.

Should the program outlined herein or a similar program be undertaken in the future, inflation and the increase in costs since the date of this study should be taken into consideration.

Recommendations of the United Nations Economic Commission for Asia and the Far East relative to barge and tug requirements in Viet-Nam is included in this report as Appendix A, for reference purposes.

APPENDIX A

BARGE AND TUG REQUIREMENTS

Source : United Nations, Economic Commission for Asia and the Far East, Cambodia, Laos, Thailand, and The Republic of Viet-Nam; Committee for Coordination of Investigation of the Lower Mekong Basin; Twenty-Second Session (Special) 21-24 November 1963, Saigon - Viet-Nam.

(Note: This Appendix taken directly from above source without changes or deletions.)

Under the technical assistance program, The United Nations sent a TAB, ILO and FAO expert mission headed by Mr. Carter Goodrich to Viet-Nam. After several months in Viet-Nam (December 1955 - February 1956) the mission prepared a report on the country's economic development prospects. We reproduce in Annex B (not attached to this Appendix) the mission's recommendations regarding inland waterway vessels. Although the report was prepared in 1956, the recommendations are still valid.

The Government is making great efforts to restore all the delta water courses to their pre-war state and is cutting new canals. However, the private sector has not ventured to invest in new barges and tugs for several reasons: lack of capital, insecurity, a much-reduced volume of freight. Only one carrier, holding the contract for army transport, has been able to build a few barges and tugs with financial assistance from the Government.

The Goodrich mission estimated that the total volume of freight carried annually before the war was about 1,200 million ton-km.

We have caluculated the minimum number of vessels needed only on the basis of essential goods such as paddy and rice, clinker, charcoal and building materials.

A. Paddy and Rice. Rice production exceeded the first five-year plan target. In 1960 the cultivated area was 2,318,000 ha., and production 4,950,000 tons of paddy, a yield of over 20 quintals per ha (the 1956 figures were 2,060,000 ha, 2,740,000 tons and 12.3 quintals). Under the second five-year plan, 6 million tons are to be produced in 1966 and 500,000 tons of rice exported. An estimated 1,400,000 tons of rice and paddy will then have to be transported; 900,000 tons of paddy for export after processing and 500,000 tons of rice for consumption in Saigon.

B. Clinker. The Ha-Tien cement works will begin production in 1964, and provision will have to be made for transporting 240,000 tons of clinker a year to Saigon.

C. Charcoal from Nam-Can: 60,000 tons a year

D. Miscellaneous goods, building materials, etc.: 100,000 tons a year.

This makes a total of 1,800,000 tons, which, multiplied by an average distance of 300 km, gives 540 million ton-km as an essential minimum.

For flexibility of operation, we have adopted the proportions of 40 per cent powered barges and 60 per cent dumb barges, the 1,800,000 tons of freight being thus divided as follows:

Powered barges	720,000 tons
Dumb barges	1,080,000 tons

The powered barges would each make 26 round trips a year, fully loaded to Saigon, thus carrying $\frac{720,000}{26}$ = 28,000 tons, i.e., 80 craft of about 350 tons each.

The dumb barges would each make 12 round trips a year: $\frac{1,080,000}{12}$ = 90,000 tons, i.e., 360 craft of 250 tons each.

The tug can make 22 round trips a year with a towing power of 1 HP for 4 tons of cargo:

$$\frac{1,080,000}{22 \times 4} = 12,300 \text{ HP, i.e., 31 tugs of 400 HP each.}$$

Conclusion

South Viet-Nam needs a river fleet consisting of:

80 powered barges of 350 tons

360 dumb barges of 250 tons

31 tugs of 400 HP.

If this program is spread over ten years, the following will have to be built each year:

8 powered barges of 350 tons

36 dumb barges of 250 tons

3 tugs of 400 HP

Saigon has one fairly well equipped French ship-building yard (CARIC) and several Vietnamese yards. The latter need the services of a ship-building expert and machine-tools (shearing, folding, bending, welding machines). A small floating dock is needed for maintenance. Diesel engine mechanics will also have to be trained.